CMTS 1000 Installation Manual V1.2

NORTEL NETWORKS™

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NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which cause the user will be required to correct the interference at his own expense.

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This product conforms to the provisions of Council Directive 89/336/EEC and 73/23/EEC.

CMTS 1000 Installation Manual V1.2

Revision 00

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NORTEL NETWORKS™

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Table of Contents

About This Document

Before You Begin xiv
Conventions xiv
Acronyms xvi
Bay Networks Technical Publications xviii
Bay Networks Customer Service xviii
How to Get Help xix
Associated Documents xx

Chapter 1 - General Description

Introduction 1-1
Cable Plant Issues 1-2
About the CMTS 1000 1-4
Benefits 1-5
Maximizes Network Performance 1-5
Ensures Connectivity 1-5
Enhances Network Security 1-5
Eases Management 1-5
Features 1-6
DOCSIS-Compliant 1-6
High-Performance Architecture 1-6
Integrated Up Converter 1-6
Class of Service 1-7
Ingress Avoidance 1-7
Secure Communications 1-7
Transparent Bridging and Layer 3 Filtering 1-8
Reliable Design 1-9
Powerful Provisioning, Management, and Maintenance Capabilities 1-9
Interoperability 1-10
Specifications 1-11
Installation and Operating Environment 1-11
Performance 1-11
Distance Supported 1-11
RF Electrical Specifications 1-12
Regulatory Specifications 1-12

Filtering Options 1-13
Ordering Information 1-13
Safety Precautions 1-13
Symbols 1-14
Modifications to Equipment 1-14
Placement of the CMTS 1000 1-14
Power Cord Connection 1-14
Pre-Installation 1-15
Hardware and Software Components 1-15

Chapter 2 - Hardware Installation

Introduction 2-1
Unpacking the CMTS 1000 Shipping Carton 2-2
Shipping Container Contents 2-2
Examining the CMTS 1000 2-2
Selecting an Installation Area 2-3
Mounting 2-3
Rack Requirements 2-3
Cooling Requirements 2-4
Power Requirements 2-5
Rack Installation 2-5
Connecting the CATV and Ethernet Network Connections 2-6
Connecting to the CATV Network 2-6
Setting the CMTS 1000 Input Power Level 2-6
Setting the Return Channel Attenuation 2-8
Setting the Return Channel Attenuation When Combining Multiple Returns 2-10
Set the Forward Channel Output Level 2-11
Connecting to the Ethernet Network 2-12

Chapter 3 - Startup Operation Procedures

Introduction 3-1
Setting Up a Basic Network 3-2
PC Installation Procedure 3-3
Required Hardware (minimum) 3-3
Required Software (minimum) 3-3

Install Hardware and Software 3-3
Descriptions of the LCn Provisioning Server Functions 3-4
LCn Login 3-4
LCn Control Panel 3-5
Devices 3-5
MIB Objects 3-6
Misc. 3-8
Admin. 3-9
Additional LCn Control Panel Options 3-11
Basic Procedures for Using LCn Provisioning Server Functions 3-12
Administration 3-12
Adding Users and Assigning Specific Admin Rights 3-12
Modify Server Configuration 3-16
Entering Device Parameters 3-17
Network Parameter Editing 3-17
Enter Network Data 3-19
Cable Modem Parameter Editing 3-25
Enter Cable Modem Data 3-26
Enter Cable Modem Termination System Data 3-37
Update Network Configuration Files 3-43

Chapter 4 - Troubleshooting

Introduction 4-1
CMTS 1000 System Console Port 4-2
Operation 4-2
Remote Connector Cabling 4-2
Using Terminal Emulation 4-4
Terminal Configuration 4-4
CMTS 1000 CLI Commands 4-5
CMTS 1000 System Front Panel 4-7
CMTS 1000 RF Test Points 4-7
-30 dB Downstream 4-7
0 dB Upstream 4-7
CMTS 1000 LEDs 4-7
Power LED 4-7

Ethernet LED 4-8
10/100 Link LED 4-8
Downstream LED 4-8
Upstream LEDs 4-8
CMTS 1000 System Panel Buttons 4-8
CMTS 1000 System Display 4-9
System Menu 4-9
Down Stream Menu 4-11
Up Stream Menu 4-12
CMTS 1000 SNMP MIB Variable Descriptions 4-14
Simple Network Management Protocol (SNMP) Overview 4-15
Management Information Base (MIB) Descriptions 4-16
Docs_Base 4-16
Docs_Software 4-21
Docs_Server 4-24
Event_Info 4-26
Event_Control 4-29
LLC_Filters 4-32
IP_Filters 4-34
DocsIF 4-39
IfDownstreamChannelEntry 4-39
IfQosProfileEntry 4-47
IfSignalQualityEntry 4-50
IfCmMacEntry 4-53
ifCmStatusEntry 4-54
ifCmServiceEntry 4-59
IfCmtsServiceEntry 4-73
IfCmtsModulationEntry 4-76
IfCmtsObjectsInfo 4-80
lccmtsif 4-81
LcCmtsUpstreamEntry 4-81
lccmtsifInfo 4-85
LcCmtsProvisioningInfo 4-86
LcModemVendorEntry 4-90
lccmtsDPStatisticsInfo 4-92

lcDPStatisticsEntry 4-93
lccmtsDPConfigurationInfo 4-94
LcScanningFrequencyEntry 4-95
lctrapvarsinfo 4-98
lcMulticastGroupInfo 4-102
LcStickyYellowEntry 4-106
lcdevicecommoninfo 4-107
DocsBpi 4-109
DocsBpiCmBaseEntry 4-109
DocsBpiCmTEKEntry 4-118
DocsBpiCmtsBaseEntry 4-123
DocsBpiCmtsAuthEntry 4-126
DocsBpiCmtsTEKEntry 4-132
DocsBpiMulticastMapEntry 4-138
Loading and Compiling the MIB 4-141

Chapter 5 - Modifying and Upgrading the CMTS 1000

Introduction 5-1
Upgrade Recommendations 5-2
Preliminary Upgrade Steps 5-3
Upgrade Procedure 5-3
Step #1: Verify Contents of Upgrade Package 5-4
Step #2: Configure TFTP File Server 5-4
Step #3: Ensure Devices Can Communicate with the TFTP Server 5-5
Step #4: Initiate Upgrade Process 5-6
Software Upgrade via SNMP 5-6
Software Upgrade via the LCn Provisioning Server's Automatic Software Upgrade 5-7
Step #5: Upgrade and Compile the Latest CMTS SNMP MIB 5-8
Step #6: Verify Upgrade Completed Successfully 5-8

About This Document

This manual describes how to do the following:

- Set up the Cable Modem Termination System (CMTS) 1000.
- Set up and use the Provisioning Server (LCn).
- Verify the CMTS installation.

If you are responsible for installing a cable modem network, including installing cable modem termination systems, you need to read this manual.

If you want	Go to
Installation preparation information for Bay Networks Cable Modem Termination System 1000	Chapter 1
Procedures to install Bay Networks Cable Modem Termination System 1000	Chapter 2
Startup operation procedures, including cable modem provisioning instruction	Chapter 3
Troubleshooting information, including detailed SNMP MIB descriptions	Chapter 4
Hardware configuration modification and upgrade information	Chapter 5

Before You Begin

Before using this document, you should be familiar with RF measuring equipment, data over cable TV system installation procedures, Cable Modem Provisioning Server, and general RF cable plant operating methods. You should also be familiar with an SNMP manager.

Conventions

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: if command syntax is **ping** *<ip_address>*, you enter **ping 192.32.10.12**
bold text	Indicates text that you need to enter, command names, and buttons in menu paths. Example: Enter **wfsm &**
	Example: Use the **dinfo** command.
	Example: ATM DXI > Interfaces > **PVCs** identifies the PVCs button in the window that appears when you select the Interfaces option from the ATM DXI menu.
brackets ([ ])	Indicate optional elements. You can choose none, one, or all of the options.
ellipsis points	Horizontal (. . .) and vertical (⋮) ellipsis points indicate omitted information.
italic text	Indicates variable values in command syntax descriptions, new terms, file and directory names, and book titles.
quotation marks (“ ”)	Indicate the title of a chapter or section within a book.

`screen text`	Indicates data that appears on the screen. Example: `Set Bay Networks Trap Monitor Filters`
separator (>)	Separates menu and option names in instructions and internal pin-to-pin wire connections. Example: Protocols > AppleTalk identifies the AppleTalk option in the Protocols menu. Example: Pin 7 > 19 > 20
vertical line (|)	Indicates that you enter only one of the parts of the command. The vertical line separates choices. Do not type the vertical line when entering the command. Example: If the command syntax is **show at routes** | **nets**, you enter either **show at routes** or **show at nets**, but not both.

Acronyms

ARP	Address Resolution Protocol
ASIC	Applications Specific Integrated Circuit
BPI	Bytes Per Inch
CATV	Community Access (Antenna) TV
CBR	Constant Bit Rate
CIR	Committed Information Rate
CM	Cable Modem
CMTS	Cable Modem Termination System
C/N	Carrier-to-Noise
CPE	Customer Premises Equipment
dB	Decibel
dBc	Decibel Carrier
dBmV	Decibel Millivolt
DES	Data Encryption Standard
DFB	Distributed Feed Back
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Service
DOCSIS	Data Over Cable Service Interface Specification
DRAM	Dynamic Random Access Memory
FEC	Forward Error Correction
FIFO	First In First Out
FTP	File Transfer Protocol
HRC	Harmonic Related Carrier
ICMP	Internet Control Message Protocol
IF	Intermediate Frequency
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPX	Internal Packet eXchange

IRC	Incremental Related Carrier
LCD	Liquid Crystal Display
LCn	LANcity Provisioning Server
LLC	Logical Link Control
LSB	Least Significant Bit
MAC	Media Access Control
Mbps	Megabytes Per Second
MIB	Management Information Base
MSO	Multiple System Operator
NIC	Network Interface Card
NMAccess	Network Management Access
NMS	Network Management System
NVRAM	Non-Volatile Random Access Memory
PDU	Protocol Data Unit
PHY	Physical Protocol Layer
pps	Packets per Second
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RDBMS	Relational Database Management System
RF	Radio Frequency
RFC	Request for Comment
RISC-	Reduced Instruction Set Computer
RSA	Rural Service Area
SID	System Identification Number
SNMP	Simple Network Management Protocol
SOHO	Small Office/Home Office
SRAM	Static Random Access Memory
STD	Standard North American
TCP/IP	Transmission Control Protocol/Internet Protocol

TEK	Traffic Encryption Key
TFTP	Trivial File Transfer Protocol
TX	Transmit
UART	Universal Asynchronous Receiver/Transmitter
UCD	Upstream Channel Descriptor
UDP	User Datagram Protocol

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Valbonne, France	33-4-92-96-69-68	33-4-92-96-69-98	baypoint@baynetworks.com

*For cable modems and cable modem family products, use Express Routing Code 174.

Associated Documents

Refer to the following documents for further information:

Refer to the following documents for further information:

- *CM 100 Subscriber Handbook V1.2 - 302694-B* directed at the end user, this document provides operating and installation instructions for the CM 100 Cable Modem.
- *CM 100 Release Notes V1.2 - 305471-B* provides additional information not available a the time of the *CM 100 Subscriber Handbook/Operating Manual's* printing.
- *CMTS 1000 Release Notes V1.2 - 305472-B* provides additional information not available a the time of the *CMTS 1000 Installation Manual's* printing.
- *DOCSIS LCn Provisioning Server Release Notes V1.0 -304764-A* provides additional information not available at the time of the *CMTS 1000 Installation Manual's* printing.

Chapter 1
General Description

Introduction

This Chapter provides installation preparation information for Bay Networks Cable Modem Termination System 1000.

The automatic installation of Cable Modem 100s (CM 100s) at end user sites is the goal of this manual.

To achieve this goal the following basic steps are described:

1. Attaining a reasonable cable plant
2. Properly configuring the DOCSIS LCn Provisioning Server
3. Properly installing the CMTS 1000

The result of achieving the above steps will be:

Every CM 100 will automatically install itself.

Cable Plant Issues

There is no simple formula to follow when configuring cable plants for cable modems. However, the goals are as follows:

- Keep the Carrier-to-Noise Ratio (C/N) to 25 dB or better at all points on the cable. (The allowable number of combined runs depends on this ratio.)
- Keep the number of translators per modem at a reasonable ratio for performance and cost.

To make a firm recommendation, it is necessary to take actual measurements on the cable plant. The options that can be taken depend on the actual system parameters.

In general, every time you double the number of runs combined at the head end, it is accompanied by a 3 dB loss in C/N. The first 3 dB loss occurs when 2 runs are combined, the next 3 db loss from 2 to 4, etc. The limit of combined runs is reached when the loss is great enough so that the C/N Ratio hits 25 or lower.

In a new installation with only a few cable modems installed, combining the runs into one CMTS return port is helpful from a cost viewpoint. But as the concentration of modems increases, runs can be split off. For example, if two runs have 500 or more cable modems, then these two runs can be split off into a new CMTS return port, and the remaining runs stay on the original CMTS return port.

As the density increases even further, it may be necessary to split out the runs so that each run has its own CMTS return port. Combining and splitting runs at the head end is a relatively easy task.

Typically, the fiber optic link is the weakest link; it creates the most noise in the upstream. This is based on the type of return laser used. In many cases, Fabler Perot lasers are used in the upstream because of their lower cost compared to DFB (Distributed Feed Back) lasers. For example, if a Fabray Perot optical link offers a C/N of 40 dB, then the total system C/N

will only get worse as you add the C/Ns from all the other contributors (i.e., Coax plant, forward, reverse and forward fiber C/Ns).

The above approach works as long as the noise level on the cable plant is low enough to allow combining a number of runs. If this is not the case, then it might be necessary to do the following:

- Start with multiple CMTS return ports with each run.
- Lower the number of combined runs going into one CMTS return port.
- Clean up the noise on the cable plant.

The best solution is as follows: Early in the process, estimate the maximum number of homes that could eventually funnel into a specific CMTS return port. Then, work toward that goal as economically as possible.

About the CMTS 1000

Bay Networks Cable Modem Termination System (CMTS) 1000 is a scalable cable access solution that allows cable operators to provide their customers with reliable access to high-speed communications links over a cable TV network. Additionally, the CMTS 1000 complies with the Data Over Cable Service Interface Specification (DOCSIS) standards, which defines standards for networking equipment that will be attached to a cable plant (i.e., the cable modem and the cable modem termination system).

Featuring a high performance reduced instruction set computer (RISC)-based architecture, the CMTS 1000 delivers the data forwarding and filtering capabilities required by the most demanding applications. The CMTS 1000 also features a 10/100 Mbps Ethernet interface. It supports a 6 MHz 64 or 256 Quadrature Amplitude Modulation (QAM) Cable TV (CATV) downstream channel, and a variable-rate Quadrature Phase Shift Keying (QPSK) or 16 QAM upstream channel. These features enable a cable operator to provide users with a flexible high-performance network access solution.

The CMTS 1000 is also fully compliant with the DOCSIS Baseline Privacy Specifications to ensure cable plant security and that end-to-end communications are kept private. It provides comprehensive filtering capabilities based on packet type, address, port, or protocol, allowing cable operators to configure their security measures to fit their exact requirements.

Cable operators can easily differentiate services for their business customers through Bay Networks MAC Scheduler which allows services to be configured by data rate or priority.

The CMTS 1000 is SNMP-manageable by any SNMP management station, such as Bay Networks Optivity family of network management applications. It can also be provisioned with its IP address and operational parameters over the network via Domain Name Service (DNS) and Dynamic Host Configuration Protocol (DHCP).

Bay Networks product line scales to support thousands to millions of modems and enables cable operators to deploy products that flexibly support a variety of customer applications, from residential to small office/home office (SOHO) to large businesses.

Benefits

Maximizes Network Performance

The CMTS 1000 provides the forwarding and filtering rates necessary to meet the most demanding applications. Additionally, by allowing cable operators to differentiate services, the CMTS 1000 can be configured to meet a customer's specific requirements.

Ensures Connectivity

Bay Networks strict adherence to the DOCSIS standards ensures interoperability with standards-based equipment from other vendors.

Enhances Network Security

The CMTS 1000 provides a comprehensive set of security features which comply with the DOCSIS Baseline Privacy Specifications for cable plant end-to-end communications.

Eases Management

Bay Networks Optivity Network Management System provides a comprehensive set of network management capabilities accessible through a point-and-click, Windows-based interface.

Features

DOCSIS-Compliant

The CMTS 1000 is fully compliant with the DOCSIS standards which include radio frequency (RF) interfaces, data interfaces, security, and operations support system interface specifications. It is also compliant with the Physical Protocol (PHY) Layer and Media Access Control (MAC) Layer characteristics as defined by DOCSIS. This strict adherence to standards enables cable operators to implement multivendor networks cost-effectively and safely.

High-Performance Architecture

Bay Networks CMTS 1000 provides a flexible software architecture based on a high-performance RISC-based engine with integrated application-specific integrated circuits (ASICs). A 10/100 Mbps Ethernet network interface, a 6 MHz 64 or 256 QAM CATV downstream channel, and a variable-rate QPSK or 16 QAM upstream channel are provided by the CMTS 1000.

The CMTS 1000 delivers the performance required by today's demanding applications. The forwarding performance of the CMTS 1000 is 50,000 packets per second (pps). The CMTS 1000 also filters at wire speed on both its 10/100 Ethernet and CATV interfaces.

Integrated Up Converter

The CMTS 1000 provides an integrated up converter capability, which converts the Intermediate Frequency (IF) to the downstream operational frequency. The integrated up converter delivers the needed functionality to translate from lower to higher frequencies at a lower cost and smaller footprint with integrated management.

Class of Service

The CMTS 1000 supports Bay Networks MAC Scheduler which allows cable operators a way of differentiating services for their business customers. Services can be configured by data rate (bits per second) both upstream and downstream, as well as by three levels of priority; which are normal, high, and network-critical. Thus offering the ability to tailor services to the individual customer's needs.

Bay Networks MAC Scheduler provides sophisticated control of the upstream and downstream channels. Offering higher performance with a much lower latency, the MAC Scheduler enables deployment of differentiated and tiered services. Class of service support is delivered via best effort Committed Information Rate (CIR) and Constant Bit Rate (CBR), with configurable maximum and minimum information rates. This is accomplished by mapping IP flows to IP addresses, ports, protocols, and type of service bits.

Ingress Avoidance

Bay Networks CMTS 1000 features an Ingress Avoidance capability that manages the operation of each upstream channel in the presence of noise, and sets operating characteristics to predetermined signal-to-noise and packet error rates. With Ingress Avoidance, the CMTS 1000 optimizes operation by dynamically changing channel width, modulation, channel frequency, and forward error-correction robustness, based on operational requirements established by the cable operator. This allows cable operators to customize their operations based on their particular cable plant characteristics and avoid problems caused by channels experiencing high signal-to-noise conditions, maximizing reliability and uptime.

Secure Communications

Bay Networks CMTS 1000 is fully compliant with the DOCSIS Baseline Privacy Specification. It delivers features that increase cable plant security and enables true end-to-end secure communications for business applications.

The CMTS 1000 is a full spanning, tree-bridging device that forwards only to known destination addresses. Information on the cable channel is isolated from the 10/100 Ethernet channel of the CMTS 1000 unless destined for a device on that port. This forwarding method prevents unauthorized access to information and content, assuring subscribers and operators security and privacy in their communications.

Cable Plant Security

Unauthorized and inadvertent access to services is prevented by the CMTS 1000. Cable plant security is enabled via single Data Encryption Standard (DES) 56-bit encryption and key management. Every CMTS 1000 has an RSA public/private key pair, which is used to exchange DES keys with a cable modem device such as the Bay Networks Cable Modem 100 (CM 100).

Advanced Packet Filtering Capabilities

The CMTS 1000 provides comprehensive filtering based on packet type, address, port and protocol.

Enhanced filtering capabilities for restricting network access and control are also provided by the CMTS 1000. Ten Logical Link Control (LLC) protocol filter entries and ten IP protocol filter entries are supported by the CMTS 1000. The LLC protocol filter entries can be used to limit the forwarding capability of the CMTS 1000 to a restricted set of Network Layer protocols such as IP, IPX, NetBIOS, and AppleTalk. The IP protocol filter entries can be used to restrict upstream or downstream traffic based on source and destination IP addresses, Transport Layer protocols such as TCP, UDP, and ICMP, and source and destination TCP/UDP port numbers.

Transparent Bridging and Layer 3 Filtering

The Ethernet-to-CATV forwarders and the Upstream-to-downstream forwarders of the CMTS 1000 are implemented as learning bridges, configurably augmented with Layer 3. The 10/100 Ethernet-to-CATV forwarder provides spanning tree as an option.

Reliable Design

Bay Networks has leveraged its many years of experience in delivering cable networking solutions in the design of the CMTS 1000. This enables cable operators to provide a standards-based, highly reliable end-to-end cable modem data networking solution using proven technologies.

Powerful Provisioning, Management, and Maintenance Capabilities

Bay Networks offers a complete set of Provisioning, Management, and Maintenance tools that ensure high network performance and reliability.

DOCSIS LCn

The Provisioning Server is a PC/Windows 95/98 based utility that is based on Microsoft Access RDBMS. The DOCSIS LCn enables you to perform the following functions “right out of the box”:

- Update modem configuration files
- Assign network-wide parameters
- Assign modem-specific parameters
- Assign IP address and mask
- Upgrade software automatically
- Control access to the network on a per modem basis
- Transfer secured parameters between server and clients
- Manage authorization key
- Provide the current time and date
- Generate reports

SNMP-Based Management

The CMTS 1000 is fully SNMP-manageable. It supports Internet Engineering Task Force (IETF) Management Information Bases (MIBs) including:

- Cable Device
- Radio Frequency
- RFC 1213 (MIB II)
- RFC 1398 (Ethernet)
- RFC 1493 (Bridge)
- RFC 1573 (Interface)
- Bay Networks Private MIB Extensions.

The CMTS 1000 is also network upgradable via the Trivial File Transfer Protocol (TFTP).

Optivity Network Management System

The CMTS 1000 is fully manageable from Bay Networks industry-leading Optivity network management system application. This powerful tool offers comprehensive status and overall network health information at a glance. Thresholds can be set in the CMTS 1000 and are continuously monitored. If a threshold is exceeded, an alarm or SNMP trap message is sent to the designated network management station. Reports can be generated based on traps as well as events.

Interoperability

Bay Networks has always been an advocate of standards as well as multivendor systems and networks. The CMTS 1000 will interoperate with any DOCSIS-compliant cable modem such as Bay Networks CM 100.

Specifications

Installation and Operating Environment

Packaging Type	19 inch rack-mount or stand-alone
Dimensions (HxWxD)	2.62 x 17.35 x 16.56 in. (6.65 x 44.0 x 42.0 cm)
Weight	18 lbs.
Operating Temperature	0× to 40×C
Storage Temperature	-40° to +66°C
Humidity	10% to 90% noncondensing
Input voltage	88 to 264 VAC 47 – 63 Hz, or -48 VDC
Input power	100 W
Ethernet Connectivity	10/100 Base-T with autonegotiate and dual (redundant) PHY connections

Performance

Forwarding rate	Better than 50,000 pps
Ethernet filtering rate	148,000 pps
CATV filtering rate, per port	14,000 pps

Distance Supported

Transit Delay

Headend to most distant CM	up to 0.800 msec
Allowable round trip delay	1.6 msec

Supports distances up to 100 miles over typical Hybrid Fiber Coax (HFC) cable plants.

RF Electrical Specifications

Downstream

RF channel spacing	6 MHz
Frequency range	88 to 860 MHz (band edges)
Modulation	64 QAM or 256 QAM
Symbol rate	5.056941 Msymbol/sec or 5.360537 Msymbol/sec
Information rate	27 Mbps or 38 Mbps
Forward error correction	Reed Solomon
Output signal range	50 to 61 dBmV
Return loss	14 dB
Transmit output power accuracy	1 dB
Output impedance	75 ohms

Upstream

RF channel spacing	Variable, 200 KHz to 3.2 MHz
Frequency range	5 to 42 MHz (band edges)
Modulation	QPSK or 16 QAM
Information rate	0.320 to 10.24 Mb/s without FEC enabled
Forward error correction	Concatenation of Reed Solomon Block Code and Trellis Code
Receive input level	-4 to 26 dBmV (operator configurable)

Regulatory Specifications

UL, CSA, FCC B, EN60950, CE (pending)

Filtering Options

Link layer	MAC addresses, Ethertype/LSAP
IP layer	Masked source and destination IP address protocol
Transport layer	UDP and TCP source and destination port ranges

Ordering Information

DE3801E01	Bay Networks Cable Modem Termination System (CMTS), Model 1000, DC power
DE3801E02	Bay Networks Cable Modem Termination System (CMTS), Model 1000, AC power

Safety Precautions

This section provides safety precautions to follow when installing the Bay Networks CMTS 1000.

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all warnings and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source matches the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

Symbols

The following international symbols appear in this book when you must perform procedures requiring proximity to electric current.

Caution - You risk damaging your equipment if you do not heed the instructions.

Warning - Hazardous voltages are present. To lessen the risk of electrical shock and danger to personal health, follow the instructions carefully.

Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. The CMTS 1000 may not meet regulatory compliance, if modified.

Placement of the CMTS 1000

Caution - To ensure reliable operation of the CMTS 1000 and to protect it from overheating, openings in the equipment must not be blocked or covered. The CMTS 1000 should never be placed near a radiator or heat register.

Power Cord Connection

Warning - The CMTS 1000 is designed to work with single-phase power systems, having a grounded neutral conductor. To reduce the risk of electrical shock, do not plug the CMTS 1000 into any other type of power system. Contact your facilities manager or certified electrician if you are not sure what type of power is supplied to your location.

Pre-Installation

This section will include tools required for installation, an installation checklist and a description of a recommended installation location.

Hardware and Software Components

A 64-bit processor is used to provide optimal packet forwarding performance. Software executes primarily from DRAM. Most time-critical software will be cached by the processor at any given time. To enhance the speed of packet forwarding, data packets and their descriptors will reside in SRAM. DRAM may be double-banked (providing single-cycle access within a burst) if performance demands it.

Memory throughput characteristics are:

- Memory bus speed of 33, 40, 44, or 50 MHz, (20-30 nsec) depending on performance needed and interaction with memory components and processor clock multiplier
- Burst-mode cycles 7-2-2-2 for cache-line refill of 32 bytes from DRAM. (7-1-1-1 if dual-banked)
- 3-cycle access to SRAM

Software and configuration parameters are stored in flash memory. Flash memory is used to store:

- Two images of software (only the latest being accessible)
- All configuration parameters in a journaled format
- A bootstrap diagnostic image
- A log of historical events which may be useful in network troubleshooting

A dual-ported UART is provided, although only one of the UART ports is used in normal operation.

Chapter 2
Hardware Installation

Introduction

This chapter describes:

- Unpacking the unit
- Identifying the contents
- Verifying the packing slip
- Finding a location for the unit
- Physically performing any installation necessary (rack-mounting)

Unpacking the CMTS 1000 Shipping Carton

To unpack the unit:

- Inspect the shipping carton before removing the unit.
- If there is evidence of damage to the carton, arrange for an agent of the carrier to be present when you remove the CMTS 1000.
- Remove the unit and the remaining contents of the shipping carton.
- The CMTS 1000 is packed tightly in protective foam molds. Carefully remove it from the carton.

After unpacking the unit, save the box and packaging materials. You can use them in case you ever have to send the unit back.

Shipping Container Contents

Check the packing slip to verify you have everything you ordered. The unit's shipping box contains the following:

- A CMTS 1000 and its power cord
- A CD containing the CMTS 1000 LCn Provisioning software, a PC based utilities program used to configure the CMTS 1000 and CM 100 operating parameters
- This document, *"CMTS 1000 Installation Manual"*

Examining the CMTS 1000

Examine the CMTS 1000 to locate the parts on the rear panel as you connect the rest of the system. Figure 2-1 shows the locations of the following items: Ethernet port(s), serial port, cable TV transmit and receive ports, power input receptacle and the AC On/Off switch.

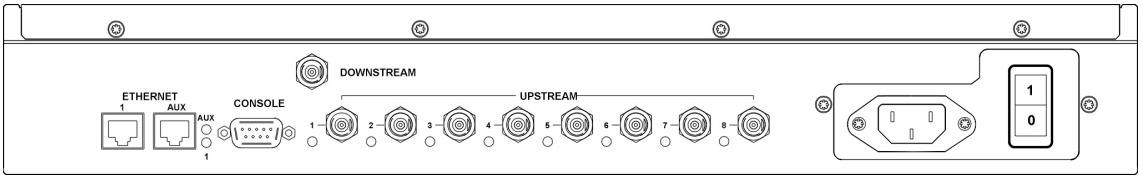

Figure 2-1 CMTS 1000 Rear Panel

Selecting an Installation Area

After unpacking the CMTS 1000, select an appropriate installation area that allows room for the CMTS 1000, as well as for the cables and power cord.

Mounting

Rack Requirements

The Bay Networks CMTS 1000 is designed to be mounted in a standard 19” rack, compliant with EIA RS-310.

Caution: The 19” rack suitable for Bay Networks CMTS 1000 installation must support a minimum of 25 pounds. Do not mount the Bay Networks CMTS 1000 in any manner that could cause a hazardous condition due to uneven mechanical loading.

Cooling Requirements

The CMTS 1000 is designed for standard rack mounting in a 19” equipment rack. It requires 2.6 inches of vertical rack space (1.5 rack units). It should be installed in a rack allowing some access to the back of the unit. The CMTS 1000 should be free of strong RF radiation emanating from local equipment in the rack. Power line transients that may cause damage to the unit should be avoided. It should be installed in a location with adequate ventilation. It is designed to operate at temperatures ranging from +5°C to +40°C.

As with all electrical equipment, operation at excessive temperature accelerates the deterioration of components and adversely effects performance. For this reason, measures should be taken to prevent the buildup of excessive heat in the rack.

Precautions should include:

- Full rack space between every unit
- Forced ventilation in an enclosed rack

Caution - CMTS 1000 has vents on the side panel for air intake. The CMTS 1000 also has a fan on the opposite side panel. When you install CMTS 1000 in a rack, make sure objects do not block the vents on the side panel or the fan on the opposite side panel.

If the CMTS 1000 is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the CMTS 1000 in an environment compatible with the maximum rated ambient temperature (Tmra), as specified in the Specifications section in Chapter 1.

Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.

Power Requirements

The equipment has an international auto-ranging internal power supply which allows it to be powered from any 100–120, 220–240 VAC (50-60 Hz) source.

Note the total current consumption of all equipment on the same line before applying power to the CMTS 1000. Avoid sharing an AC source that feeds heavy motors or other equipment that requires large current drains.

Caution: Circuit Overloading – Consideration should be given to the connection of the CMTS 1000 to the supply circuit and the effect that overloading of circuits might have on overcurrent protection and supply wiring. Appropriate consideration of the CMTS 1000 nameplate ratings should be used when addressing this concern.

Warning: To reduce the risk of electric shock, always plug the Bay Networks CMTS 1000 power cord into a grounded power outlet. Power outlet ground must be permanently connected to the power service earth ground.

Rack Installation

Refer to Figure 2-2. Install CMTS 1000 in the rack. Support unit and align holes in front mounting ears with holes in the front mounting rail. Secure with the four screws and washers that are provided.

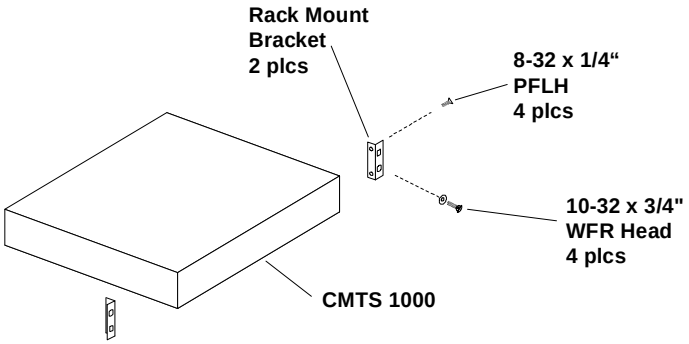

Figure 2-2 CMTS 1000 Rack Mounting

Connecting the CATV and Ethernet Network Connections

Connecting to the CATV Network

Before you connect the CMTS 1000 to your cable system, you should perform or understand the following procedures:

- Set the CMTS 1000 input power level
- Set the return channel attenuation
- Set the return channel attenuation when multiple returns are combined
- Set the forward channel output level

Setting the CMTS 1000 Input Power Level

The CMTS 1000 provides the CM 100 and other Data Over Cable Service Interface Specification (DOCSIS) compliant cable modems with all the information they need to become operational.

One piece of information the CMTS 1000 provides cable modems is the Upstream Channel Descriptor (UCD). A UCD contains information that describes the general characteristics of the upstream (return) channel such

as the center frequency of the channel and the channel's bandwidth. The UCD provides other information to the cable modems such as burst type and burst descriptor. Refer to the *Cable Modem Termination System 1000 Administration and Operations Manual* for a detailed description of the UCD.

After a CM 100 learns how to receive (Scanning) and acquires a downstream channel, it can then learn how to transmit (Ranging). The cable modem, after learning how to receive and transmit, listens for UCDs and MAPs.

You set the input power level to where you want the CMTS 1000 to receive, based on the transmission rates at which you want the CM 100 cable modems to transmit. The CMTS 1000 transmits Upstream Channel Descriptors periodically informing all CM 100s in its operating frequencies of all the upstream channel characteristics, including transmit power.

Table 2-1 shows the CMTS 1000 input power level ranges for each of the five symbol rates and both modulation modes.

Table 2-1 CMTS 1000 Upstream Demodulator Input Power Characteristics

Symbol Rate	Modulation Format		Channel Width	Power Range
	QPSK	16 QAM		
Ksym/sec	Kbits/sec	Kbits/sec	KHz	dBmV
160	320	640	200	-16 to +14
320	640	1,280	400	-13 to +17
640	1,280	2,560	800	-10 to +20
1,280	2,560	5,120	1,600	-7 to +23
2,560	5,120	10,240	3,200	-4 to +26

Perform the following procedure to set the CMTS 1000 input power level.

Setting the CMTS 1000 input power level is accomplished via an SNMP MIB variable or the Command Line Interface. Both procedures are not available as of this printing.

Setting the Return Channel Attenuation

The designed output level of the last active device of the network must be known. If fiber connects the last amplifier, you have to know the designed output level of the Fiber Receiver node at the headend.

The designed input level to the first active device of the return channel is a prerequisite to knowing the designed output level of the last active device.

Locate the return combiner. It is selected for connecting to the input of one of the eight network inputs of the CMTS 1000.

Record the loss for that combiner and any other loss between the combiner and the last amplifier driving the input of the combiner.

Subtract the loss from the designed output level. It is the level as predicted at that output with the required input to the trunk amplifiers.

Example:

	30	dBmV	designed last active device output level
–	7	dB	combiner loss
=	23	dBmV	

Select return channel attenuation to provide optimum CM 100 signal to first active amplifier. The output level of the combiner is used as the starting point.

Example:

	23 dBmV	level to be padded for CMTS 1000 input
minus +	1 dBmV	desired input level to CMTS 1000
	= 22 dB	return channel pad

The CM 100's automatic power adjust, initiated by a received UCD containing the proper upstream channel characteristic, causes all CM 100 transmitters to hit the input of the RF-to-Fiber Transceiver, or the first active amplifier, at the same level.

The automatic power adjustment range is 43 dB (+8 to +55 dBmV) for CM 100 16 QAM transmissions and 50 dB (+8 to +58 dBmV) for CM 100 QPSK transmissions.

The attenuation for the return (upstream) path at the headend determines the value of the signal level at the input to the return channel amplifiers.

In forward path calculations, the key reference point is the output level of the amplifier. For return path calculations, the input level to the first active device becomes the key reference point. Once the level is known, by system design, all return path losses and gains back to the headend and CMTS 1000 are accounted for.

The key for selecting the attenuation for the return path is knowing the input level to the first active device.

The cable modems minimum output is +8 dBmV. The path loss from the subscriber location to the first active device must be sufficient enough so that a lower level is not required to reach the designed input level of the first active device.

When this process is followed, the return path is optimized for the 43 dB (16 QAM) or 50 dB (QPSK) of cable modem TX range. The path loss from the subscriber to the first active device cannot exceed these ranges. If exceeded, the cable modem transmitter would be at its maximum output and not be able to reach the TX level required to provide optimum performance.

Setting the Return Channel Attenuation When Combining Multiple Returns

To optimize the return path for the correct signal levels, the output of the return combiner should be within ±1.5 dB of the lowest signal before padding.

For example, when six nodes are combined, the test signal is injected to be at the designed input level for the first active element/amplifier.

As the test signal is injected, measure the input level to the combiner at the headend and record the level. The lowest level signal becomes the reference for adjusting the level to the input of the combiner. In Figure 2-3, the lowest level signal is the input at **F**, 24 dBmV.

The signals should be padded at the input of the combiner to be within ±1.5 dB of the lowest signal. If a signal is 2 dB hotter than the lowest signal, add a 3 dB pad to make it 1 dB lower. See the input at **D**.

If a signal is 4 dB hotter than the lowest signal, add a 3 dB pad to make it 1 dB hotter. See the input at **B**.

This ensures that when the remote nodes auto-adjust their transmit levels, they will not exceed the designed input level of the first active device.

Follow the return pad selection instructions for the pad on the output of the combiner.

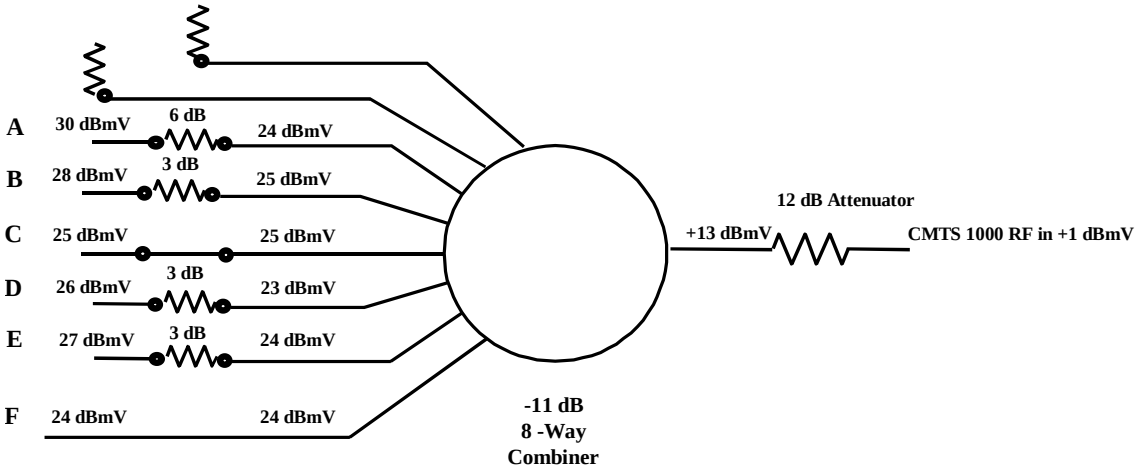

Figure 2-3 Setting Return Attenuation When Combining Multiple Returns

Set the Forward Channel Output Level

The CMTS 1000's downstream frequency plan complies with Harmonic Related Carrier (HRC), Incremental Related Carrier (IRC) or Standard (STD) North American frequency plans.

The CMTS 1000 outputs an RF modulated signal with the following characteristics (partial listing):

- Center Frequency: 91 to 857 MHz ±30 KHz
- Level: Adjustable over the range 50 to 61 dBmV
- Modulation Type: 64 QAM and 256 QAM

Setting the CMTS 1000 forward channel's output power level is accomplished via an SNMP MIB variable. This procedure is not available as of this printing.

Connecting to the Ethernet Network

Prior to connecting the CMTS 1000 to the Ethernet network, perform the following checks to verify that you have the correct connection available.

- If connection will be made to a 10Base-T hub, switch or router (concentrator), you should have a standard (straight through) eight-pin RJ-45 modular jack connectorized patch cable. If connection is made directly to a PC or workstation network interface card (NIC), you should have a crossover eight-pin RJ-45 modular jack connectorized patch cable.

Chapter 3
Startup Operation Procedures

Introduction

This chapter describes:

- Setting up the Data Over Cable System Interface Specification (DOCSIS) LCn Provisioning Server
- Descriptions of the LCn Provisioning Server functions
- Basic procedures for using LCn Provisioning Server functions

Setting Up a Basic Network

The following steps are used to set up a Cable Modem network using the LCn utility.

1. Install DOCSIS LCn Provisioning Server
2. Login with default user ID and password
3. Modify the default user password, if desired
4. Add new users with desired access rights
5. Modify the server configuration to create the correct format output
6. Create a new authorization key for the network, or accept the default
7. Create a service class with the required parameters, or accept the default
8. Create a network with the required parameters
9. Add the cable modems and cable modem termination systems to the configuration
10. Start the servers if they are running on the LCn PC
11. Update the network configuration files to create the run time tables and files

PC Installation Procedure

Required Hardware (minimum)

- Pentium PC with 16 MB of RAM memory and 500 MB of free disk space
- Ethernet Network Interface Card (NIC) for the PC

Required Software (minimum)

DOCSIS LCn Provisioning Server by Bay Networks, Broadband Technology Division, and the following:

Microsoft Windows 95, Microsoft Windows 98, or Microsoft Windows NT running its TCP/IP stack, and FTP's OnNet server with its DHCP and TFTP servers active.

Install Hardware and Software

Install Microsoft Windows and FTP's OnNet server following the manufacturer's directions.

Install the Ethernet Card in your PC following the manufacturer's directions. Run the diagnostics before proceeding, to ensure that the card is configured properly without any conflicts.

Install Microsoft's TCP/IP stack following the manufacturer's directions.

Notes:

- Install LCn Server following the directions in the LCn readme file.
- Configure the LCn server using the server configuration menu provided (refer to appropriate section of this document).
- Create a TFTP default directory called LCN_DATA.

Descriptions of the LCn Provisioning Server Functions

LCn Login

When you start LCn, it displays the Login Screen shown in Figure 3-1.

Figure 3-1 LCn Login Screen

Login to the LCn using the default name and password. The default user name and password are as follows:

`User name:` **admin**
`Password:` **admin**

You can change the password later. Only one user at a time can be logged in to the LCn.

The Login screen option buttons include:

- **`Enter`** – Checks for a valid ID and password and displays the LCn Control Panel.
- **`Exit`** – Exits the LCn application.
- **`Change Password`** – Checks for a valid ID and password and displays the change password screen.

LCn Control Panel

After you log in to the system, LCn displays the DOCSIS LCn Provisioning Server Control Panel as shown in Figure 3-2 with the CM Devices tab on top.

To access the functions, click the appropriate tab and option button. Access to these functions can be enabled or disabled according to the access control list for the user.

The following selections are available from the LCn Control Panel:

Devices

The LCn Control Panel's Devices tab includes the Networks, Modems and CMTS option buttons allowing access to the Networks, CMs and CMTS editing functions.

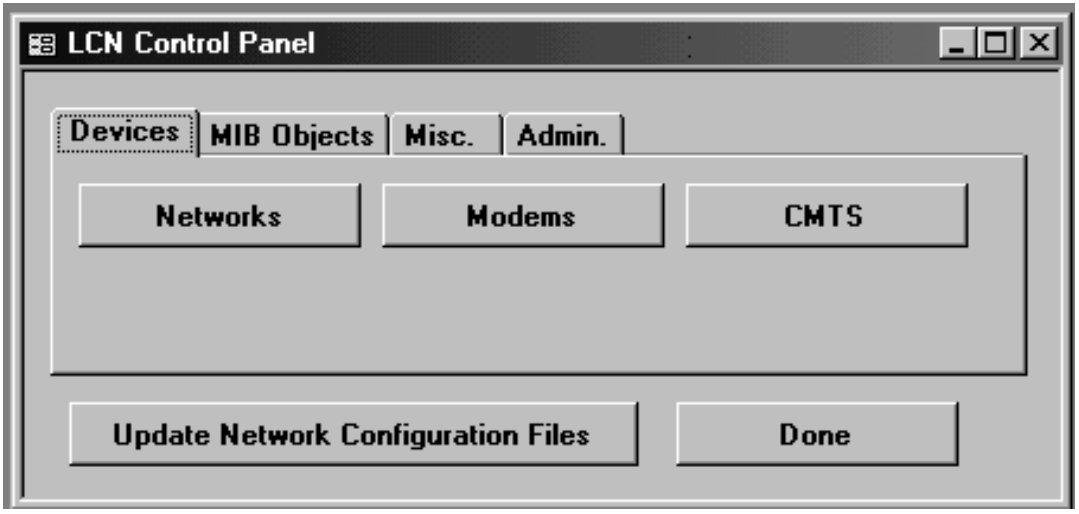

Figure 3-2 LCn Control Panel CM Devices Tab

Networks

The Networks option provides access to the network-wide parameter editing functions. Normally, it is restricted to network support level personnel. When updates have been completed, the operator regenerates the run time files and tables used by the runtime support.

Modems

The Modems option provides access to the cable modem parameter editing functions.

CMTS

The CMTS option provides access to the cable modem termination system parameter editing functions.

MIB Objects

The LCn Control Panel's MIB Objects tab, as shown in Figure 3-3, includes Filters, Write Access, and Assign Values options allowing access to these editing functions.

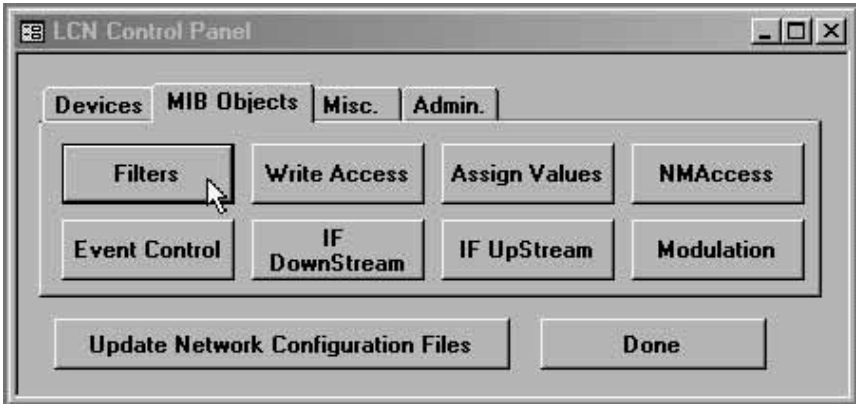

Figure 3-3 LCn Control Panel MIB Objects Tab

Filters

The Filters option allows you to create and maintain SNMP filters through LCn.

Write Access

The Write Access option allows you to enable or disable setting specific MIB variables for targeted cable modems.

Assign Values

The Assign Values option allows you to assign values to SNMP objects.

NMAccess

The NMAccess (Network Management Access) option specifies the IP addresses and community strings to manage the modem.

Event Control

The Event Control option defines the way Syslog messages are generated and the way events are tracked and reported.

IF Downstream

The IF Downstream option defines the downstream channel used by a given CMTS.

IF Upstream

The IF Upstream option defines the upstream channel used by a given CMTS.

Modulation

The Modulation option defines the modulation characteristics of various parts of the upstream channel.

Misc.

The LCn Control Panel's Misc. tab, as shown in Figure 3-4, includes Class of Service, Privacy, and Print Reports options allowing access to these editing functions.

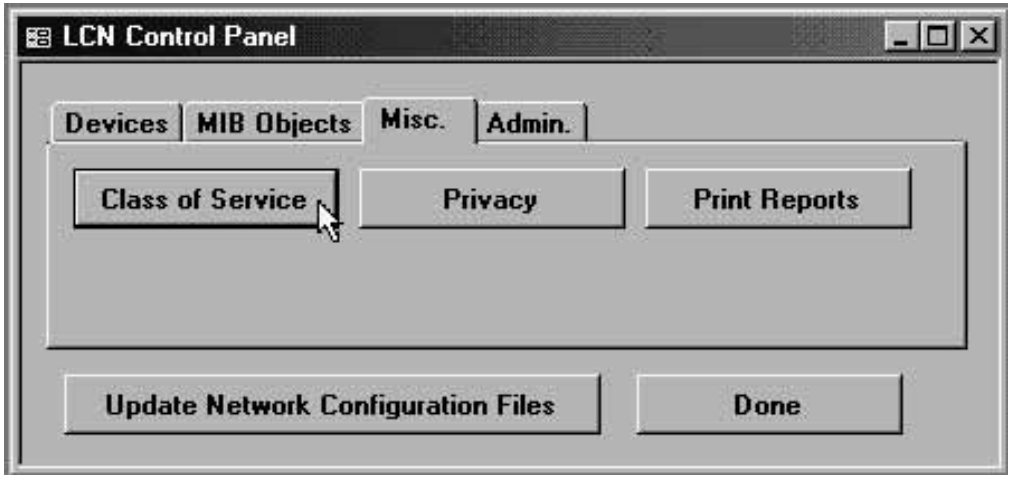

Figure 3-4 LCn Control Panel Misc. Tab

Class of Service

The Class of Service button allows you to add, edit or delete a class of service. The cable modem must be assigned a service class. It inherits parameters from the class.

Privacy

The Privacy button allows you to enable, disable, or edit the Baseline Privacy Configuration settings.

Print Reports

The Print Reports button, when implemented, will allow you to print specific reports about the data over cable network, such as: network parameter, access rights, bandwidth assignment, etc.

Admin.

The LCn Control Panel's Admin. tab, as shown in Figure 3-5, includes Users, Keys, MIB Objects, Serial Numbers, Modify Server, and Import Database options, allowing access to these editing functions.

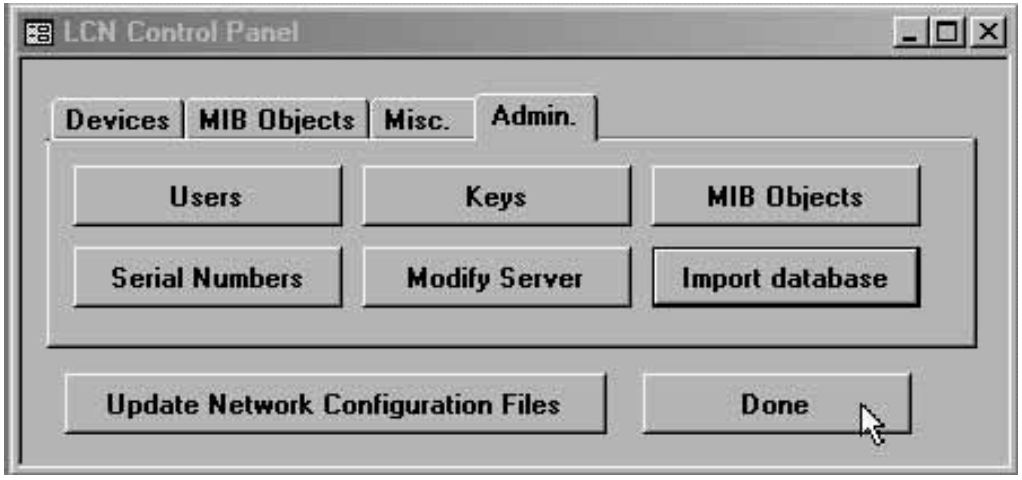

Figure 3-5 LCn Control Panel Admin. Tab

Users

The User option enables you to add, edit, or delete an LCn user. For editing or deleting, the administrator selects the LCn user from the Users table. This table is a list of all LCn users in alphabetical order.

Keys

The Keys option enables you to add, edit, or delete the authorization key that is used to ensure that only an authorized server provides parameters to the cable modems. It uses an MD5 digital signature to authorize all parameter assignments.

MIB Objects

Unlike the MIB Objects tab on the LCn Control Panel, which allows you to create and maintain SNMP Filters, enable and disable MIB variables, and assign values to MIB variables through the LCn; the MIB Objects button of the LCn Control Panel Admin. Tab allows you to import new MIBs and edit established MIBs.

Serial Numbers

The Serial Numbers option allows you to import serial numbers and MAC addresses from a text file. The Serial Numbers option also allows you to edit the Serial Numbers database.

Modify Server

The Modify Server button allows you to edit the LCn Server configuration options.

Import Database

The Import Database button, when implemented, will allow you to import an LCn database from a previous version format to the latest version LCn. This option will also allow a user to convert a current version format to the next version format.

Additional LCn Control Panel Options

The following buttons are located below the LCn Control Panel tabs:

Update Network Configuration Files

The Update Network Configuration Files option enables you to create the configuration files and tables required by the run time software component of the LCn.

Done

The Done button, when pressed, takes you back to the login screen.

Basic Procedures for Using LCn Provisioning Server Functions

The following paragraphs provide basic instruction on how to use the LCn Provisioning Server.

Administration

Before you add your first CM 100 and CMTS 1000 to the LCn Provisioning Server's database, you'll need to perform some light LCn set up functions, such as:

- Adding Users
- Modify Server Configuration

Adding Users and Assigning Specific Admin Rights

After you install the LCn and its supporting software, you need to add users that you wish to have access to the LCn. To add users to the LCn database and assign specific admin rights, perform the following procedure.

1. From the LCn Control Panel, click on the Admin tab. LCn displays the LCn Control Panel Admin Tab screen, as shown in Figure 3-5.
2. Click on Users. LCn displays the Users screen as shown in Figure 3-6

.

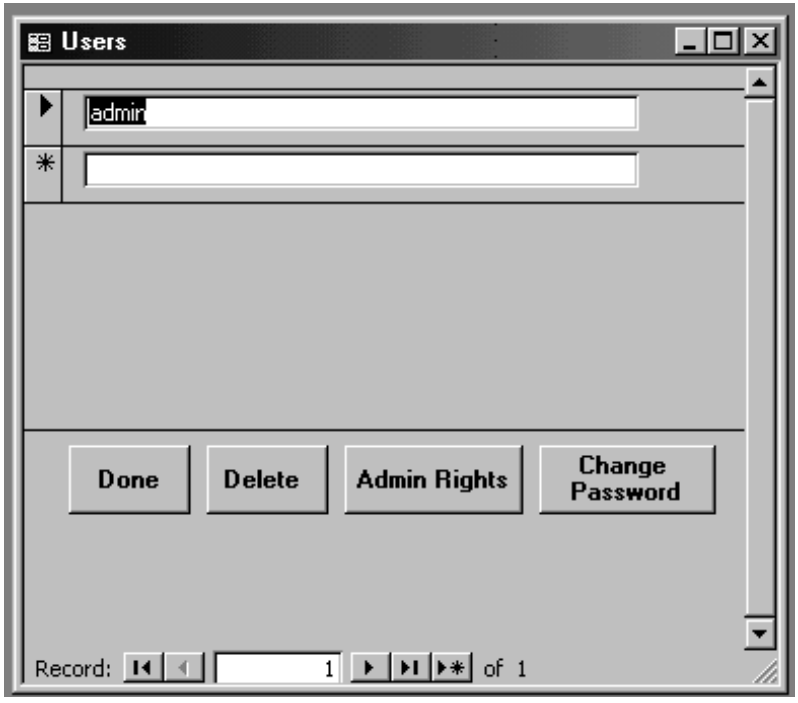

Figure 3-6 LCn Users

3. Enter the name of the LCn user. This is the name that the user enters when he or she is logging in to the LCn. It will be validated against the access control list in the database before a user is granted access to the system
4. Click on Admin Rights. LCn displays the Admin Rights screen as shown in Figure 3-7.

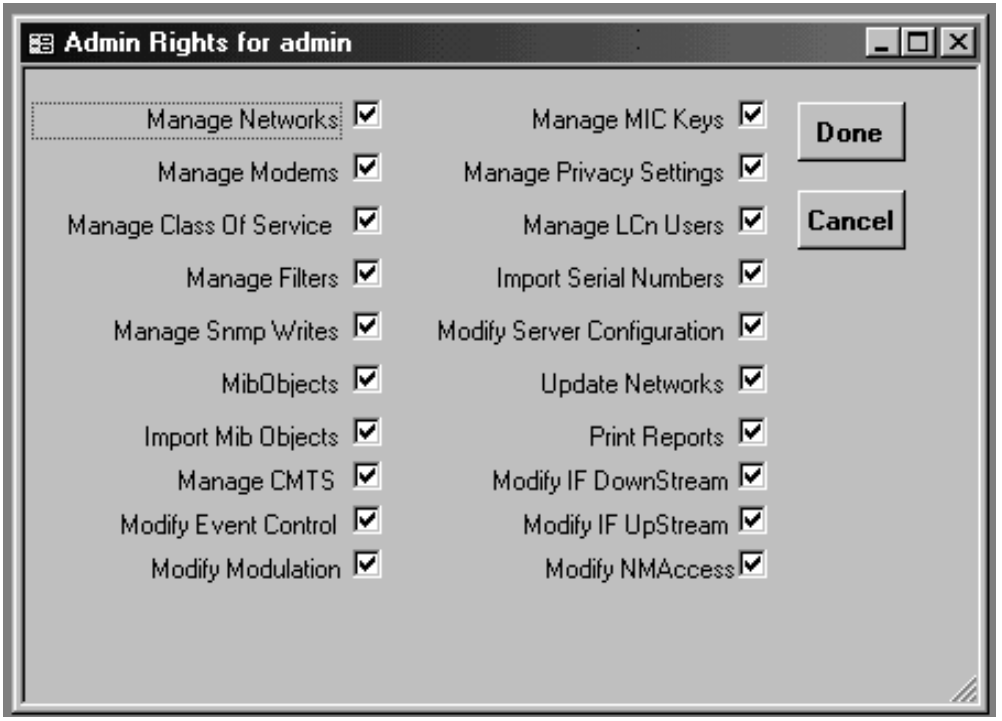

Figure 3-7 Admin Rights

5. Clicking on the box next to a specific Admin Rights function allows the entered user to access that function. Refer to Table 3-1 for a description of each Admin Rights function.
6. To return to the LCn Control Panel, click Done; LCn returns to the Users screen. Click done, LCn returns to the Control Panel Admin Tab screen.

Table 3-1 Admin Rights

Function	Description
Manage Networks	When enabled, the user will have access to the modify network data parameters and functions.
Manage Modems	When enabled, the user will have access to the modify cable modem parameters and functions.
Manage Class of Service	When enabled, the user will have access to the modify service class parameters and functions.
Manage Filters	When enabled, the user will have access to the modify filters parameters and functions.
Manage SNMP Writes	When enabled, the user will have access to the modify SNMP writes parameters and functions.
MibObjects	When enabled, the user will have access to the MIB objects function.
Import Mib Objects	When enabled, the user will have access to the import MIB objects function.
Manage MIC Keys	When enabled, the user will have access to the modify service class parameters and functions.
Manage Privacy Settings	When enabled, the user will have access to the manage privacy settings parameters and functions.
Manage LCN Users	When enabled, the user will have access to manage all LCn users.
Import Serial Numbers	When enabled, the user will have access to the import serial numbers function.
Modify Server Configuration	When enabled, the user will have access to the modify server configuration function.
Update Networks	When enabled, the user will have access to update the network configuration files.
Print Reports	When enabled, the user will have access to the print reports function.

Modify Server Configuration

Access to this function is from the Modify Server option of the LCn Control Panel Admin Tab screen. It allows you to configure the LCn server, including identifying the proper TFTP File Directory and DHCP Directory. The TFTP File Directory is where the LCn holds its configuration files. The DHCP Directory is where the DHCP Server is located.

Click the Modify Server option on the LCn Control Panel Admin Tab screen. LCn displays the Server Configuration screen (see Figure 3-8). To accept the defaults, click Done.

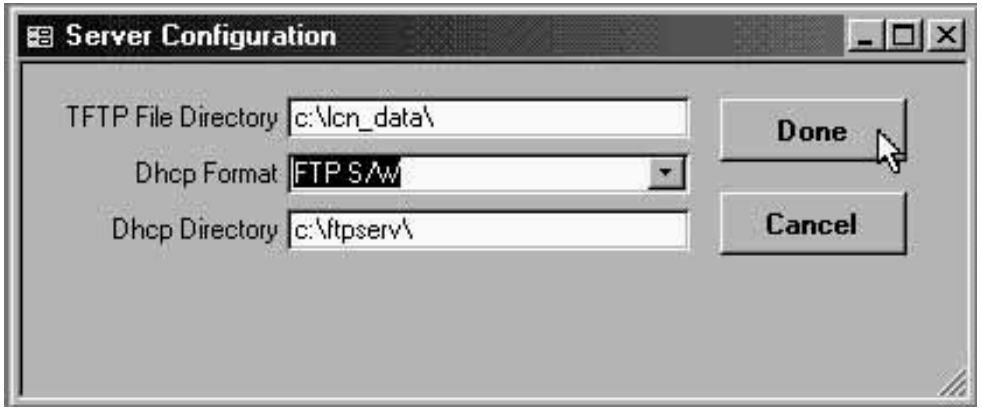

Figure 3-8 LCn Modify Server Configuration

TFTP File Directory

Enter the name of the CM Configuration File Directory. This directory will contain the configuration files after they are generated. If the LCn run time component and the database maintenance portion are on the same system, this directory should be the default directory for the TFTP server.

DHCP Format

Select the appropriate format for the DHCP Server. The format used by DHCP servers is not standard. Thus, the DHCP table must be generated in a format that matches the one required by the run time component.

DHCP Directory

Enter the name of the DHCP Directory. This field allows you to define the directory in which the DHCP Server software is installed.

Entering Device Parameters

The following sections describe the basic procedures for adding networks, cable modems, and cable modem termination systems to the DOCSIS LCn Provisioning Server database.

Network Parameter Editing

Before you add devices (CMs and CMTSs) to your LCn Provisioning Server, you need to set up networks to which they will be assigned. Select the Networks option from the LCn Control Panel's Devices Tab. LCn displays the Networks Screen shown in Figure 3-9.

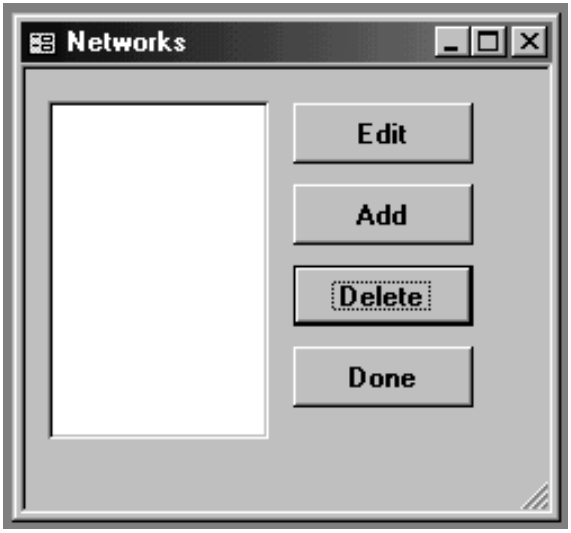

Figure 3-9 Edit Networks

The following fields appear on this screen.

Network Name

The Network Name window displays a list of the network names in alphabetical order.

Edit

This option displays the Network Parameter editing screen. When you select a network, the LCn displays the associated data on the parameter editing screen. If no network is selected, a blank screen is displayed.

Add

This option is used to add a new network to the system. You do not have to enter a network name. The next screen to be displayed is the network parameter editing screen. As no network has been selected, a blank screen is displayed.

Delete

This option deletes the selected network. If no network is selected, an error message is displayed.

Done

This returns you to the previous screen.

Enter Network Data

You can add parameters for a new network or edit parameters for an existing network using the Enter Network Data screen (see Figure 3-10). For existing networks, you select a network from the Edit Networks screen list and click on edit. All fields are filled in from the appropriate records in the database. Changes to this data should be made by network operations staff who have appropriate networking and product training.

When you click on Add, an intermediate screen appears prior to LCn displaying the Enter Network Data screen. This screen requests that you enter a name for the new item. Enter a name for the network and press OK.

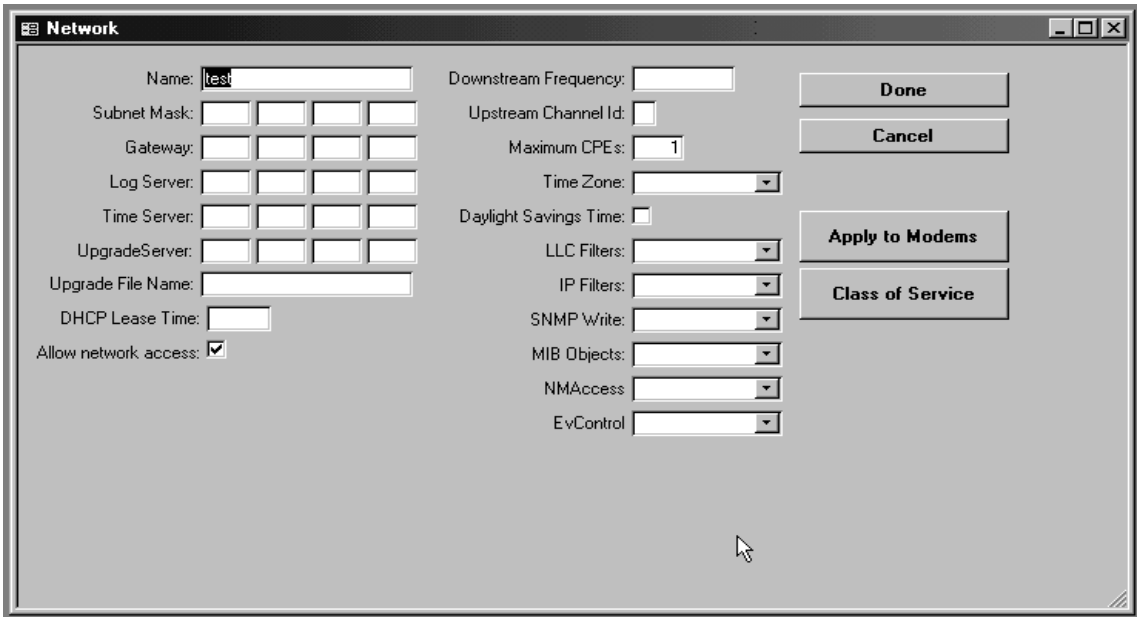

Figure 3-10 Enter Network Data

The following fields appear on this screen.

Network Name

This free format field enables you to assign a name to the network.

Subnet Mask

This field allows you to enter the IP address mask to be used by all CMs in this network. The value for the mask should be provided by the network operations department.

Gateway

The entry in this field is the default gateway IP address. It is to be used by all CMs in this network to access all networks other than the local one. The value should be provided by the network operation's department.

Log Server

The entry in this field is the IP address of the log server. It is used by all CMs in this network. If the parameters read from the LCn during boot up are not acceptable due to an invalid message digest, the LCn sends an SNMP trap to the log server. The value should be provided by the network operations department.

Time Server

The entry in this field is the IP address of the Time Server. It is used by all CMs in this network.

Upgrade Server

The entry in this field is the IP address of the Upgrade Server. It is used by all CMs in this network.

Upgrade File Name

This entry is the TFTP file name of the CM operating software that you wish to have the CM load during an automatic software upgrade.

DHCP Lease Time

The length of time for which the assigned IP address is valid. The lease will be automatically renewed.

Allow Network Access

Checking the Network Access Allowed box allows the CM to access to the network after it has received suitable parameters. The LCn provides these parameters at boot up (providing no errors occur during this process). If the box is not checked, the modem will not function, even if it receives valid parameters from the LCn. Since CMs revalidate their parameters each time they reboot, this check box provides a simple mechanism to bar a modem from the network.

Downstream Frequency

The receive frequency entered in this field (in MHz) is the one used by all CMs in this network.

Upstream Channel ID

The Upstream Channel ID, which the CM must use, is an override for the channel selected during initialization.

Maximum CPEs

The entry in this field allows you to control the maximum number of Customer Premises Equipment (CPE) that a CM will support. The CM supports from a single client node up to sixteen client nodes.

Time Zone

The entry in this field is the timezone. It will be used by all CMs in this network. It is updated from the timezone's table of the database. It is used in the time stamps in the CM event log.

Daylight Savings Time

Check this box when daylight savings time is in effect. It is used in the time stamps used in the CM event log.

LLC Filters

This option allows you to add a Logical Link Control (LLC) filter to all CMs on this network. An LLC filter must be created using the LCn Control Panel MIB Objects Tab Filters option before you can add a filter type to a network.

IP Filters

This option allows you to add an Internet Protocol (IP) filter to all CMs on this network. An IP filter must be created using the LCn Control Panel MIB Objects Tab Filters option before you can add an IP Filter to a network.

SNMP Write

The entry in this field is the SNMP community to which the CM belongs for SNMP sets. The community string entered here must match the one used by the network manager in order for a CM to reply to an SNMP set.

A manager knowing this string has write access to the CM. It is used in all SNMP set requests by a network manager.

MIB Objects

This option allows you to add a MIB object to all CMs on this network. A MIB object must be created using the LCn Control Panel Admin Tab MIB objects option before you can add a MIB Object to a network.

NMAccess

This option allows you to add IP addresses of Network Management stations with specific access levels to all CMs on this network. An NMAccess entry must be created using the LCn Control Panel MIB Objects Tab NMAccess option before you can add an authorized Network Management station to a network.

EVControl

This option allows you to add an Event Control entry to all CMs on this network. An Event Control must be created using the LCn Control Panel MIB Objects Tab Event Control option before you can add an EVControl to a network.

Done

This option returns you to the previous screen.

Cancel

This option button allows you to cancel any changes that you made to the Enter Cable Modem Data screen. LCn returns you to the Modem select screen.

Apply to Modems

When you click on the Apply to Modems option button, LCn applies the entered Network Data parameters to all cable modems on this network. LCn provides an opportunity for you to accept or decline the changes.

This process can also be implemented from the Enter Cable Modem Data screen. Refer to the Enter Cable Modem Data section for information on entering Network Defaults for individual cable modems.

Class of Service

You use this button to enter Class of Service as a Network Default. Class of Service can also be assigned to each modem individually by clicking on the Class of Service option button accessed from the Enter Cable Modem Data screen.

Refer to the Enter Cable Modem Data section for information on entering Class of Service for individual cable modems.

Cable Modem Parameter Editing

The following paragraphs describe the basic procedure for editing cable modem parameters.

Select the Modems option from the LCn Control Panel's Devices Tab. LCn displays the Modems Screen shown in Figure 3-11.

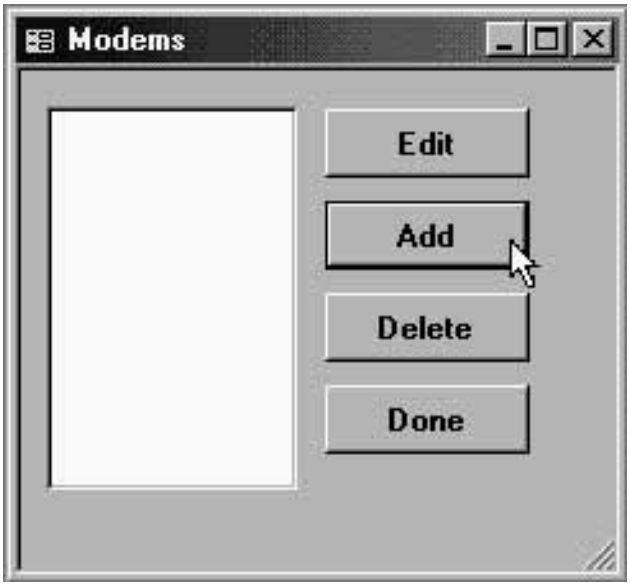

Figure 3-11 Edit Modems

The following fields appear on this screen.

Cable Modem Name

The Cable Modem Name window displays a list of the cable modem names in alphabetical order.

Edit

This option displays the cable modem parameter editing screen. When you select a cable modem, the LCn displays the associated data on the parameter editing screen. If no cable modem is selected, a blank screen is displayed.

Add

This option is used to add a new cable modem to the system. You do not have to enter a cable modem name. The next screen to be displayed is the cable modem parameter editing screen. If no cable modem has been selected, a blank screen is displayed.

Delete

This option deletes the selected cable modem. If no cable modem is selected, an error message is displayed.

Done

This returns you to the previous screen.

Enter Cable Modem Data

You can add parameters for a new cable modem or edit parameters for an existing cable modem using the Enter Cable Modem Data screen (see Figure 3-12). For existing cable modems you select a cable modem from the list on the Modems screen and click on Edit. All fields are filled in from the appropriate records in the database. Changes to these data should be made by network operation's staff who have appropriate networking and product training.

When you click on Add, an intermediate screen appears prior to LCn displaying the Enter Cable Modem Data screen. This screen requests that you enter a name for the new item. Enter a name for the cable modem and press OK.

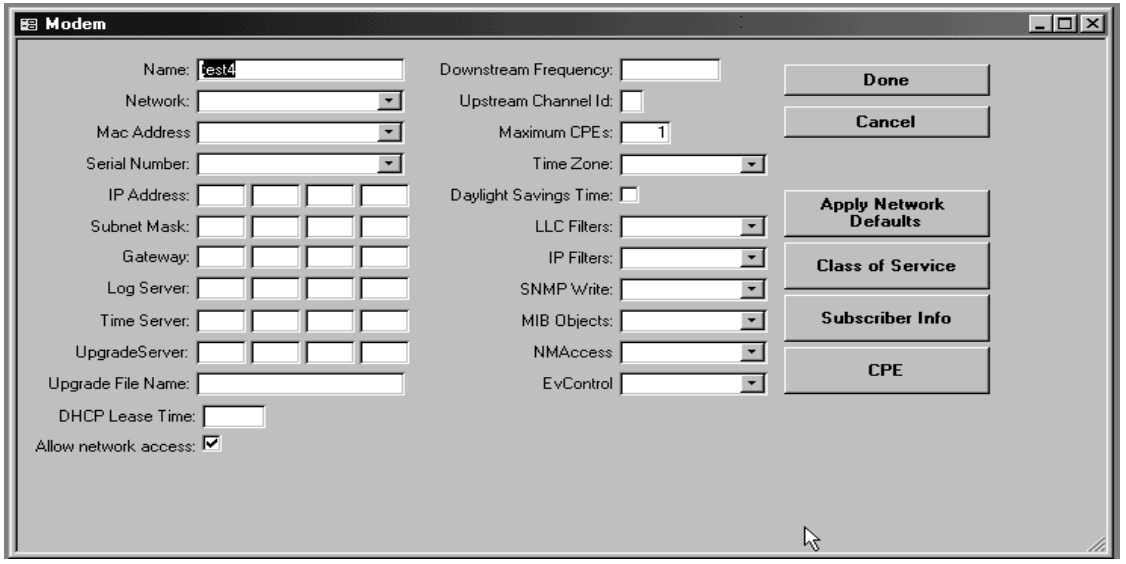

Figure 3-12 Enter Cable Modem Data

The following fields appear on this screen.

Name

This free format field enables you to assign a name to the cable modem.

Network

This option enables you to assign this cable modem to a network. Its pull down menu displays the networks that were defined for this system (refer to the network parameter section of this document). The cable modem must be assigned to an existing network; it inherits parameters from the network. When you select a network, a pop up dialog box asks if the network defaults should be applied to this cable modem.

Select the Apply option to fill in the network subnet mask and other network fields with default values that may have been entered when you defined your networks. The values are the network-wide values. These fields may still be modified to customize an individual cable modem after the defaults have been applied.

MAC Address

This field is the MAC address of the cable modem. The information is available from the cable modem label.

Serial Number

If you need to enter a cable modem serial number directly, it is available from the cable modem label. Type it into the field or read it from the bar code label on the cable modem with an appropriate bar code reader.

IP Address

The IP address is used in the management of the cable modem. It does not need to be a globally routable IP address. Normally, it will be assigned by the network operations group. The address will be transferred to the DHCP server. The LCn run time component uses the IP address when the network configuration files are updated. The IP address is transferred to the modem when it boots.

Subnet Mask

This field allows you to enter the IP address mask to this cable modem that will be used by all CMs in this network. The value for the mask should be provided by the network operations department.

Gateway

The entry in this field is the default gateway IP address. It is to be used by all CMs in this network to access all networks other than the local one. The value should be provided by the network operations department.

Log Server

The entry in this field is the IP address of the log server. It is used by all CMs in this network. If the parameters read from the LCn during boot up are not acceptable due to an invalid message digest, the LCn sends an SNMP trap to the log server. The value should be provided by the network operations department.

Time Server

The entry in this field is the IP address of the Time Server. It is used by all CMs in this network.

Upgrade Server

The entry in this field is the IP address of the Upgrade Server. It is used by all CMs in this network.

Upgrade File Name

This entry is the TFTP file name of the CM operating software that you wish to have the CM load during an automatic software upgrade.

DHCP Lease Time

The length of time for which the assigned IP address is valid. The lease will be automatically renewed.

Allow Network Access

Checking the Allow Network Access box allows the CM access to the network after it has received suitable parameters. The LCn provides these parameters at boot up (providing no errors occur during this process). If the box is not checked, the modem will not function, even if it receives valid parameters from the LCn. Since CMs revalidate their parameters each time they reboot, this check box provides a simple mechanism to bar a modem from the network.

Downstream Frequency

The receive frequency entered in this field (in MHz) is the one used by all CMs in this network.

Upstream Channel ID

The Upstream Channel ID, which the CM must use, is an override for the channel selected during initialization.

Maximum CPEs

The entry in this field allows you to control the maximum number of Customer Premise Equipment (CPE) that this CM will support. The CM supports from a single client node up to sixteen client nodes.

Time Zone

The entry in this field is the timezone. It is updated from the timezones table of the database. It is used in the time stamps in the CM event log.

Daylight Savings Time

Check this box when daylight savings time is in effect. It is used in the time stamps used in the CM event log.

LLC Filters

This option allows you to add a Logical Link Control (LLC) filter to all CMs on this network. An LLC filter must be created using the LCn Control Panel MIB Objects Tab Filters option before you can add a filter type to a network.

IP Filters

This option allows you to add an Internet Protocol (IP) filter to all CMs on this network. An IP filter must be created using the LCn Control Panel MIB Objects Tab Filters option before you can add an IP Filter to a network.

SNMP Write

The entry in this field is the SNMP community to which the CM belongs for SNMP Sets. The community string entered here must match the one used by the network manager in order for a CM to reply to an SNMP Set.

A manager knowing this string has write access to the CM. It is used in all SNMP set requests by a network manager.

MIB Objects

This option allows you to add a MIB Object to all CMs on this network. A MIB Object must be created using the LCn Control Panel Admin Tab MIB Objects option before you can add a MIB Object to a network.

NMAccess

This option allows you to add IP addresses of Network Management stations with specific access levels to all CMs on this network. An NMAccess entry must be created, using the LCn Control Panel MIB Objects Tab NMAccess option before you can add an authorized Network Management station to a network.

EVControl

This option allows you to add an Event Control entry to all CMs on this network. An Event Control must be created using the LCn Control Panel MIB Objects Tab Event Control option before you can add an EVControl to a network.

Done

This option button returns you to the previous screen.

Cancel

This option button allows you to cancel any changes that you made to the Enter Cable Modem Data screen. LCn returns you to the Modem select screen.

Apply Network Defaults

When you click on the Apply Network Defaults option button, LCn applies the common parameters it uses for all cable modems on this network to this Enter Cable Modem Data screen. LCn provides an opportunity for you to accept or decline the changes.

Class of Service

Every cable modem must be assigned a Class of Service. This option can be entered as a Network Default, or a Class of Service can be assigned to each modem individually by clicking on the Class of Service option button. LCn displays a list of service classes as shown in Figure 3-13. Service classes are created using the Class of Service option button accessed from the LCn Control Panel Misc. tab

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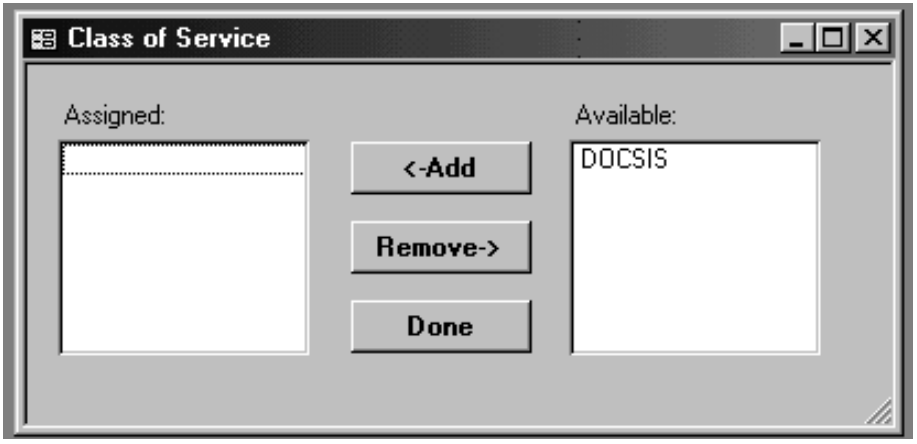


Figure 3-13 Class of Service

Subscriber Information

The Subscriber Information screen provides you with an option to add additional data to the basic cable modem parameters (see Figure 3-14). This information is offered as a convenience to the Multiple System Operators (MSOs).

The fields allow you to add information that relates to the subscriber and an optional free format notes section. This additional data is maintained in the database and is related to the cable modem via the MAC address field of the base modem parameters.

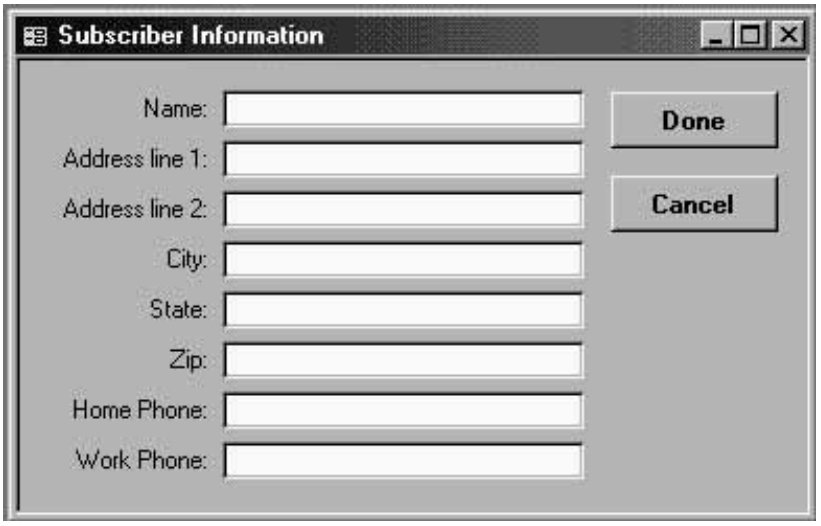


Figure 3-14 Subscriber Information

The following fields appear on this screen.

Name

This free-format field allows you to enter the name of the subscriber.

Address line 1

This free-format field allows you to enter the street address of the subscriber.

Address line 2

This free-format field allows you to enter the street address of the subscriber.

City

This free-format field allows you to enter the city or town of the subscriber.

State

This free-format field allows you to enter the state of the subscriber.

Zip

This field allows you to enter the postal code of the subscriber. It is formatted for a 9 digit Zip code.

Home Phone

This field allows you to enter the home phone number of the subscriber.

Work Phone

This field allows you to enter the work phone number of the subscriber.

Done

This option button returns you to the previous screen.

Cancel

This option button allows you to cancel any changes that you made to the Subscriber Information screen, and LCn returns you to the Modem screen.

CPE

The CPE (Customer Premise Equipment) option button allows you to enter the MAC addresses of the clients attached to the cable modem, using the Cust. Premise Equip. MAC Addresses screen shown in Figure 3-15.

The clients' MAC Addresses will be displayed in the SNMP Forwarding Database Table with a status of mgmt (management).

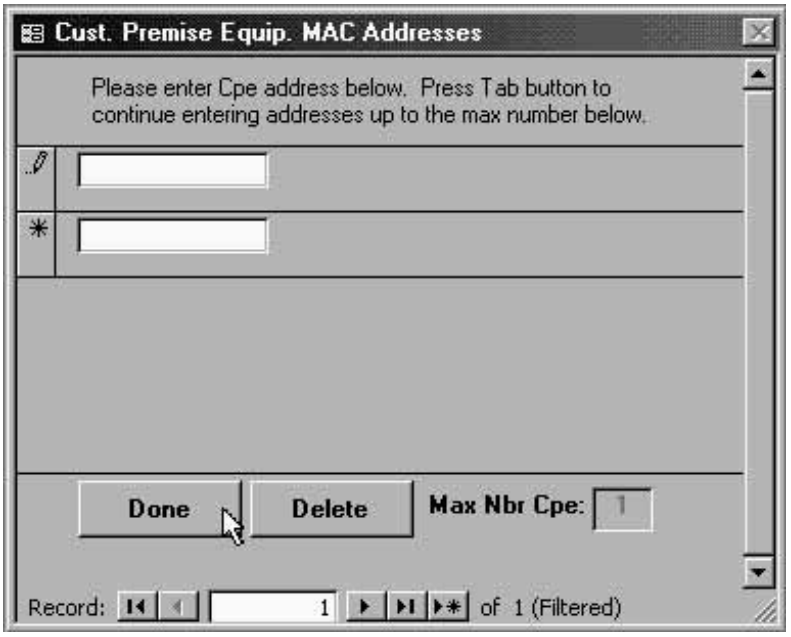


Figure 3-15 Cust. Premise Equip. MAC Addresses

The following fields appear on this screen.

CPE MAC Address List

This entry field allows you to enter CPE MAC addresses up to the maximum number of characters allowed.

Done

This option button returns you to the previous screen.

Delete

Highlighting an entered address in a field will delete it.

Max Nbr Cpe

This entry is the total number of CPE MAC Addresses that is allowed to be entered on this screen. The Max Nbr Cpe count is taken from the Enter Cable Modem Data screen's Maximum CPEs entry.

Enter Cable Modem Termination System Data

You can add parameters for a new CMTS or edit parameters for an existing CMTS using the Enter CMTS Data screen (see Figure 3-16). For existing CMTS' you select a CMTS from the list on the Modems screen and click on Edit. All fields are filled in from the appropriate records in the database. Changes to this data should be made by network operation's staff who have appropriate networking and product training.

When you click on Add an intermediate screen appears prior to LCn displaying the Enter CMTS Data screen. This screen requests that you enter a name for the new item. Enter a name for the CMTS and press OK.

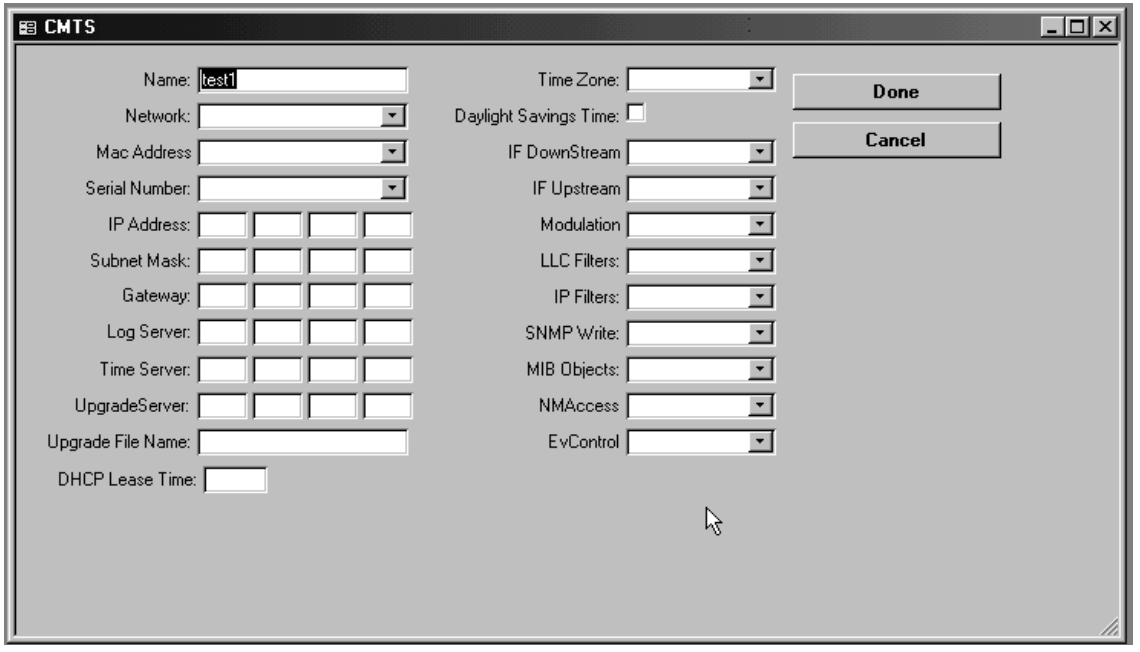


Figure 3-16 Enter CMTS Data

The following fields appear on this screen.

Name

This free-format field enables you to assign a name to the CMTS.

Network

This option enables you to assign this CMTS to a network. Its pull down menu displays the networks that were defined for this system (refer to the network parameter section of this document). The CMTS must be assigned to an existing network; it inherits parameters from the network. When you select a network, a pop up dialog box asks if the network defaults should be applied to this CMTS.

Select the Apply option to fill in the network Subnet Mask and other network fields with default values that may have been entered when you defined your networks. The values are the network-wide values. These fields may still be modified to customize an individual CMTS after the defaults have been applied.

MAC Address

This field is the MAC address of the CMTS. The information is available from the CMTS label.

Serial Number

If you need to enter a CMTS serial number directly, it is available from the CMTS label. Type it into the field or read it from the bar code label on the CMTS with an appropriate bar code reader.

IP Address

The IP Address is used in the management of the CMTS. It does not need to be a globally routable IP address. Normally, it will be assigned by the network operations group. The address will be transferred to the DHCP server. The LCn run time component uses the IP address when the network configuration files are updated. The IP address is transferred to the modem when it boots.

Subnet Mask

This field allows you to enter the IP address mask to this CMTS. The value for the mask should be provided by the network operations department.

Gateway

The entry in this field is the default gateway IP address. It is to be used by the CMTS in this network to access all networks other than the local one. The value should be provided by the network operations department.

Log Server

The entry in this field is the IP address of the log server. It is used by the CMTS in this network. If the parameters read from the LCn during boot up are not acceptable due to an invalid message digest, the LCn sends an SNMP trap to the log server. The value should be provided by the network operations department.

Time Server

The entry in this field is the IP address of the Time Server. It is used by the CMTS in this network.

Upgrade Server

The entry in this field is the IP address of the Upgrade Server. It is used by the CMTS in this network.

Upgrade File Name

This entry is the TFTP file name of the CMTS operating software that you wish to have the CMTS load during an automatic software upgrade.

DHCP Lease Time

The length of time for which the assigned IP address is valid. The lease will be automatically renewed.

Time Zone

The entry in this field is the timezone. It is updated from the timezone's table of the database. It is used in the time stamps in the CMTS event log.

Daylight Savings Time

Check this box when daylight savings time is used in this locale. It is used in the time stamps used in the CMTS event log.

IF Downstream

The forward frequency entered in this field (in MHz) is the one used by all CMs in this network.

IF Upstream

The return frequency entered in this field (in MHz) is the one used by all CMs in this network.

Modulation

This option allows you to add a Modulation Profile for this CMTS. A Modulation Profile must be created using the LCn Control Panel MIB Objects Tab Modulation option button before you can add a Modulation Profile to a CMTS.

LLC Filters

This option allows you to add a Logical Link Control (LLC) filter to all CMs on this network. An LLC filter must be created using the LCn Control Panel MIB Objects Tab Filters option before you can add a filter type to a CMTS.

IP Filters

This option allows you to add an Internet Protocol (IP) filter to this CMTS. An IP filter must be created using the LCn Control Panel MIB Objects Tab Filters option before you can add an IP Filter to a CMTS.

SNMP Write

The entry in this field is the SNMP community to which the CMTS belongs for SNMP Sets. The community string entered here must match the one used by the network manager in order for a CMTS to reply to an SNMP set.

A manager knowing this string has write access to the CMTS. It is used in all SNMP set requests by a network manager.

MIB Objects

This option allows you to add a MIB Object to this CMTS. A MIB Object must be created using the LCn Control Panel Admin Tab MIB Objects option before you can add a MIB Object to a CMTS.

NMAccess

This option allows you to add IP addresses of Network Management stations with specific access levels to this CMTS. An NMAccess entry must be created using the LCn Control Panel MIB Objects Tab NMAccess option before you can add authorized Network Management stations to a CMTS.

EVControl

This option allows you to add an Event Control entry to this CMTS. An Event Control must be created using the LCn Control Panel MIB Objects Tab Event Control option before you can add an EVControl to a CMTS.

Done

This option button returns you to the previous screen.

Cancel

This option button allows you to cancel any changes that you made to the Enter CMTS Data screen, and LCn returns you to the CMTS select screen.

Update Network Configuration Files

Click the Update Network Configuration Files option button of the LCn Control Panel. LCn displays the Update Network screen (see Figure 3-17).

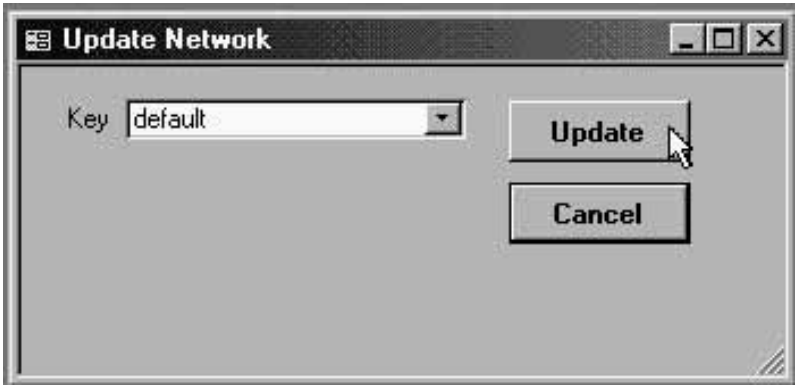


Figure 3-17 Update Network

The following fields appear on this screen.

Key

Selects the authorization key from the pulldown menu. This menu displays a list of the names of all authorization keys in alphabetical order. This authorization key is used to authenticate the configuration files. Additional Keys can be created using the LCn Control Panel Admin. Tab Keys Option button.

Update

Creates the configuration files. If a network and key are not selected, an error message is displayed.

Cancel

This returns the user to the previous screen.

Chapter 4
Troubleshooting

Introduction

This chapter describes connecting to the CMTS 1000's console port interface used for remote management and troubleshooting. Also included are descriptions of:

- CMTS 1000 system Command Line Interface (CLI)
- CMTS 1000 System Front Panel including the System Display
- CMTS 1000 system SNMP enterprise-specific MIB (Management Information Base) variables

In addition, this chapter includes the latest workaround information for known problems.

CMTS 1000 System Console Port

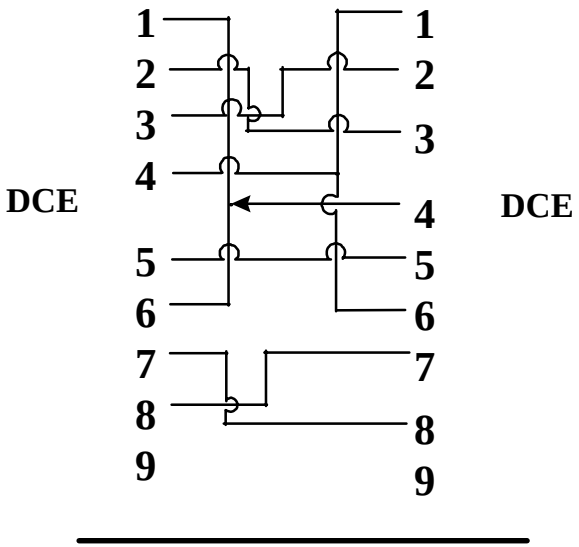
Operation

The CMTS 1000 may be controlled via its RS-232 Remote Interface connector. The connector is located on the CMTS rear panel, adjacent to the 10Base-T Ethernet ports, and is labeled Console.

The input data rate is 9600 baud. There are no user settings for the CMTS 1000 System Console Port.

Remote Connector Cabling

Figure 4-1 shows the pinouts for a 9-pin to 9-pin cable used to connect the CMTS 1000 Console Port to PC. Figure 4-2 shows the pinouts for a 9-pin to 9-pin cable used to connect the CMTS 1000 Console Port to a telephone modem.



1 DCD - Data Carrier Detect
2 RD - Receive Data
3 TD - Transmit Data
4 DTR - Data Terminal Ready
5 SG - Signal Ground
6 DSR - Data Set Ready
7 RTS - Request to Send
8 CTS - Clear to Send
9 RI - Ring Indicator

Figure 4-1 DB9 F/F Null Modem Cable Pinout

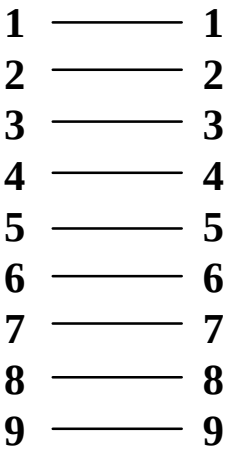


Figure 4-2 DB9 Serial Modem Cable Pinout

Using Terminal Emulation

Terminal Configuration

It is possible to communicate with the CMTS 1000 using any standard terminal program (i.e., the Terminal.exe with Win3.1 or Win95). It is also possible to use HyperTerminal with Win95 and Win98. The following connection settings are required to communicate with the CMTS 1000.

Port settings

- Com Port = COM 1 or COM 2
- Baud = 9600
- Data Bits = 8
- Stop Bits = 1
- Parity = none
- Flow Control = none (off)

Emulation

VT100

Miscellaneous

- Function, arrow, and Ctrl keys as Terminal Keys
- Append LF (line feed) to incoming line ends

Using CMTS 1000 Command Line Interface (CLI)

CMTS 1000 CLI Commands

Table 4-1 provides a brief overview of the CMTS 1000's CLI commands with descriptions.

Refer to CMTS 1000 Release Notes V1.2 (305472-B Rev 00) for detailed descriptions of the CMTS 1000's CLI commands.

Table 4-1 CMTS 1000 CLI Commands

Command	Description
help	Prints the console commands.
help <command>	Prints detailed help on the commands.
authentication	Sets authentication screen.
bp	Sets/displays baseline privacy information.
community	Modifies, adds or deletes CLI session community.
elog	Displays the event log. This is particularly useful because it shows when modems go off-line.
exit	Exits the consoles session.
get	Gets an SNMP object.
ipaddress	Sets/displays IP addressing.
logout	Exits the consoles session.
Manage	Manages the MIB.
modems	Displays the modems that the CMTS is currently seeing and whether each modem has registered. Note that when a modem goes off-line it disappears from this table. The “index” numbers in the table always increment, which lets you see whether modems went off-line. Equivalent MIB: docsIfCmtsCmStatusTable, which gives you more information.
more	When mode is on, allows controlled access to more than 24 lines of display.

The downstream and upstream port statistics count additional MAC management messages that are part of the DOCSIS protocol; these are not counted in the cable statistics.

This is a simple check to determine whether the Ethernet and Cable interfaces are working at all.

CMTS 1000 System Front Panel

The following paragraphs describe the CMTS 1000 front panel, shown in Figure 4-3. The CMTS 1000 System Display Panel descriptions are included.

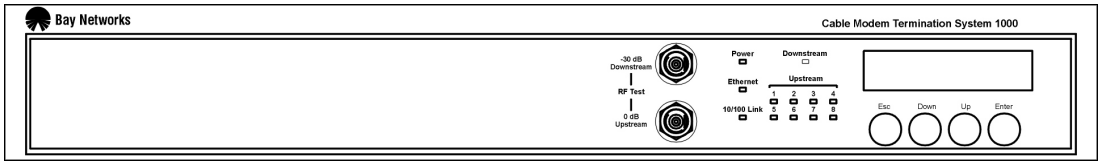


Figure 4-3 CMTS 1000 Front Panel

CMTS 1000 RF Test Points

-30 dB Downstream

The CMTS 1000 RF Downstream test point allows you to determine the downstream, (CMTS 1000 transmit) signal level minus 30 dB.

0 dB Upstream

The CMTS 1000 RF Upstream test point allows you to determine the upstream, (CMTS 1000 receive) signal level without any added attenuation.

CMTS 1000 LEDs

Power LED

When the CMTS 1000 Power LED is on solid it indicates power is being supplied to the unit.

Ethernet LED

The Ethernet LED flashes when there is transmit or receive activity through its port.

10/100 Link LED

This LED is on solid when the unit is connected to an Ethernet device, such as a hub, switch or gateway. The color of the LED turns green when connected to a 10 Mbps Ethernet device; and turns amber when connected to a 100 Mbps Ethernet device.

Downstream LED

The Downstream LED flashes when there is activity through the CMTS RF transmit port.

Upstream LEDs

The eight Upstream LEDs flash when there is activity through an active CMTS RF receive port.

CMTS 1000 System Panel Buttons

There are four pushbuttons directly below the LCD, labeled: Esc, Down, Up and Enter. You use these buttons to access menu items on the CMTS 1000 System Display.

CMTS 1000 System Display

The CMTS 1000 System Display is an LCD providing two lines of text, each 16 characters long.

You can access 16 menu items via three menu groups using the CMTS 1000 System Display of which 7 can be modified using the CMTS 1000 CLI. In addition, when the CMTS 1000 is operational, the Display Menu displays its serial number. The following paragraphs describe the CMTS 1000 System Display Menu items.

Toggling the Down or Up buttons causes the LCD to display one of the three group menu headings. The three group menu headings include:

- System Menu
- DnStm Menu (Downstream Menu)
- UpStm Menu (Upstream Menu)
- Pressing the Esc button causes the LCD to return to the group menu heading

System Menu

Figure 4-4 shows the LCD displaying the System Menu heading.

Pressing the Enter button causes the LCD to display the first of eight System Menu items. Pressing the Up or Down button causes the LCD to display the next item in the System Menu list. The following paragraphs describe the System Menu items.

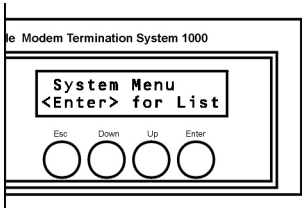


Figure 4-4 System Menu Heading

System Name

The first item on the System Menu is the System Name parameter. The System Name parameter is displayed in the first or top line of the LCD display. The actual System Name is displayed in the second or bottom line of the LCD display. If the CMTS 1000 has no System Name, then the LCD displays no system name set.

System State

The second item on the System Menu is the System State parameter. There are currently four states in which the CMTS 1000 can be. The first two states, Up and Quiet, have no additional status information. The third and fourth states, ReqSvc and Down, show additional information on the status line.

System Up Time

When selected, the System Up Time parameter displays the actual time in days, hours, minutes, and seconds that the CMTS 1000 has been operational.

System Modems

The System Modems parameter displays the total number of registered modems by displaying Active and Number in the LCD status line.

System IP Address

The System IP Address parameter: displayed, `System Addr`, shows the IP address of the CMTS 1000 in the LCD status line.

System MAC Address

The System MAC Address parameter: displayed, `System MAC Addr`, shows the MAC address of the CMTS 1000 in the LCD status line.

System Revision

The System Revision parameter displays both the hardware and software revision levels of the CMTS 1000 mother board in the LCD status line.

System Temperature

The System Temperature parameter: displayed, `System Temp`, shows the rounded-up temperature in both Fahrenheit and Celsius scales.

Down Stream Menu

From the serial number display, toggling the Down or Up buttons causes the LCD to display one of the three group menu titles.

As discussed in the System Menu section, toggling the Down or Up buttons eventually causes the LCD to display the Downstream Menu heading: displayed, `DnStm Menu`.

After the LCD displays the `DnStm Menu` heading, pressing the Enter button causes the LCD to display the first of four DnStm Menu items. Pressing the Up or Down button causes the LCD to display the next item in the DnStm Menu list.

The following paragraphs describe the DnStm Menu items.

Down Stream State

The Downstream State parameter: displayed, `DnStm State`, shows three states. The first two, Up and Down, include the relative transmit power in decibels per millivolt (8 to 58 dBmV) along with the RF driver state and modulation format `Q64` (QAM64) or `Q256` (QAM256).

The third state, `RevSvc`, shows a hex code used by maintenance personnel.

Down Stream Center Frequency

The Downstream Center Frequency parameter: displayed, `DnStm Cent Freq`, shows the Frequency Plan, either `Std` (Standard), `HRC` (Harmonically Related Carrier), or `IRC` (Incrementally Related Carrier). It also displays the center frequency of the channel in megahertz. Note: Only valid center frequencies from the North American Frequency Plan are acceptable.

Down Stream Channel Plan

The Downstream Channel and Plan parameter: displayed, `DnStm Chan/Plan`, shows the channel number for the Frequency Plan. It also displays the Frequency Plan, either `Std` (Standard), `HRC` (Harmonically Related Carrier), or `IRC` (Incrementally Related Carrier).

Down Stream Power Level

The Downstream Power Level parameter: displayed, `DnStm Power Lvl`, shows the output power into a 75 Ohm load in decibels per millivolt.

Up Stream Menu

From the serial number display, toggling the Down or Up buttons causes the LCD to display one of the three group menu titles.

As discussed in the System Menu section, toggling the Down or Up buttons eventually causes the LCD to display the UpStm Menu (Upstream Menu) heading.

After the LCD displays the UpStm Menu heading, pressing the Enter button causes the LCD to display the first of four UpStm Menu items. Pressing the Up or Down button causes the LCD to display the next item in the UpStm Menu list. The following paragraphs describe the UpStm Menu items.

Up Stream State

The Upstream State parameter: displayed, `UpStm State`, shows the Port state for up to eight ports of Upstream data, one port at a time. Indication per port includes Port Number (`P1` through `P8`) and State (`Up`, `Down`, and `ReqSvc`). The Up and Down states include no additional information. But the ReqSvc state includes a hexidecimal code used for maintenance purposes.

Up Stream Center Frequency

The Upstream Center Frequency parameter: displayed, `UpStm Cent Freq`, shows the Center Frequency of Upstream data. Indication per port includes Port number and Center Frequency in megahertz.

Up Stream Modulation Format and Bandwidth

The Upstream Modulation Format and Bandwidth parameter: displayed, `UpStm ModFmt/BW`, shows the modulation format (`QPSK` or `QAM16`) and bandwidth (`200KHz`, `400KHz`, `800KHz`, `1600KHz`, or `3200KHz`). Indication per port includes Port number, Modulation method, and Maximum Channel width.

Upstream Input Level

The Upstream Input Level parameter: displayed, `UpStm Input Lvl`, shows the Port number and the input power level in dBmV.

CMTS 1000 SNMP MIB Variable Descriptions

The CMTS 1000 is fully SNMP manageable. Table 4-2 shows the SNMP standard, impending standard, and enterprise specific Management Information Base (MIBs) groups that the CMTS 1000 support.

Table 4-2 CMTS 1000 Supported MIBs

Standard & Enterprise Specific	MIB Type	MIB Prefix
RFC 1213	MIB II	sys, if, ip, icmp, tcp, udp, snmp
RFC 1215	Trap	various
RFC 1493	Bridge	dot1d
RFC 1573	SNMPv2	if
RFC 1643	Ethernet Like Interfaces	dot3
Internet Engineering Task Force (IETF)	Cable Device	docsdev
Internet Engineering Task Force (IETF)	Radio Frequency (Interface)	docsif
Internet Engineering Task Force (IETF)	Baseline Privacy	docsbpi
Bay Networks Enterprise Specific	CMTS	lccmts
Bay Networks Enterprise Specific	CM	lccm

The following paragraphs provide a brief overview of SNMP.

Simple Network Management Protocol (SNMP) Overview

The Simple Network Management Protocol is a member of the TCP/IP protocol suite. The CMTS 1000 uses the User Datagram Protocol (UDP) to exchange messages between a station manager, such as SNMPc™ or Optivity SNMP Manager, and its onboard SNMP agent.

SNMP encompasses three main areas:

- A small set of management operations
- Definitions of manageable variables
- Data representations

The operations allowed are: Get, GetNext, and Set. These functions operate on variables that exist in the CMTS 1000. Examples of variables include static counters (Achieved Pacer Counter - lcachievedpacer), and the CMTS 1000 port status (IfEntry - OperStatus).

All of the SNMP management functions are carried out through these simple operations. No action operations are available, but these can be simulated by the setting of flag variables. For example, to reset the CMTS 1000, an integer variable named “docsdevresetnow” is set to a specific value to reset the CMTS 1000.

SNMP variables are defined using the Abstract Syntax Notation One (ASN.1). ASN.1 specifies how a variable is encoded in a transmitted data frame; it is very powerful because the encoded data is self-defining. For example, the encoding of a text string includes an indication that the data unit is a string, along with its length and value. ASN.1 is a flexible way of defining protocols, especially for network management protocols where nodes may support different sets of manageable variables.

Management Information Base (MIB) Descriptions

The set of SNMP variables that the CMTS 1000 supports is called the Management Information Base (MIB). The MIB is made up of several parts. The CMTS 1000 provides support for the data described in Table 4-2 via SNMP. The MIB groups that are in the process of becoming standards, and those that are enterprise specific are described in the following paragraphs.

DocsDev

DocsDev is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings. All of which reside under the MIB variable table name DocsDevMIBObjects.

Docs_Base

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsDevBaseInfo table.

Role

Variable Name:	docsDevRole
Set/Get Response/Status:	cm(1), cmtsActive(2), cmtsBackup(3)
Description:	Defines the current role of this device.

DateTime

Variable Name:	docsDevDateTime
Set/Get Response/Status:	Date and Time
Description:	The date and time, with optional timezone information.

ResetNow

Variable Name:	docsDevResetNow
Set/Get Response/Status:	TruthValue
Description:	Setting this object to true (1) causes the device to reset. Reading this object always returns false (2).

SerialNumber

Variable Name:	docsDevSerialNumber
Set/Get Response/Status:	DisplayString
Description:	The manufacturer’s serial number for this device.

STPControl

Variable Name:	docsDevSTPControl
Set/Get Response/Status:	stEnabled(1), noStFilterBpdu(2), noStPassBpdu(3)
Description:	This object controls operation of the spanning tree protocol (as distinguished from transparent bridging). If set to stEnabled(1), then the spanning tree protocol is enabled, subject to bridging constraints. If noStFilterBpdu(2), then spanning tree is not active, and Bridge PDUs received are discarded. If noStPassBpdu(3), spanning tree is not active and Bridge PDUs are transparently forwarded. A device need not implement all of these options, but that noStFilterBpdu(2) is required.

docs_NmAccess

This table provides one level of security for access to the device by network management stations. Note that access is also constrained by the community strings and any vendor-specific security.

This table controls access to SNMP objects by network management stations. If the table is empty, access to SNMP objects is unrestricted. For each entry in this table, the contents are not readable unless the management station has read-write permission.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsDevNmAccessEntry table.

Index

Variable Name:	docsDevNmAccessIndex
Set/Get Response/Status:	Number
Description:	Index used to order the application of access entries.

Ip

Variable Name:	docsDevNmAccessIp
Set/Get Response/Status:	IP Address
Description:	The IP address (or subnet) of the network management station. The address 255.255.255.255 is defined to mean any NMS. If traps are enabled for this entry, then the value must be the address of a specific device.

IpMask

Variable Name:	docsDevNmAccessIpMask
Set/Get Response/Status:	IP Address
Description:	The IP subnet mask of the network management stations. If traps are enabled for this entry, then the value must be 255.255.255.255.

Community

Variable Name:	docsDevNmAccessCommunity
Set/Get Response/Status:	DisplayString
Description:	The community string to be matched for access by this entry. If set to the null string, then any community string will match.

Control

Variable Name:	docsDevNmAccessControl
Set/Get Response/Status:	none(1), read(2), readWrite(3), roWithTraps(4), rwWithTraps(5), trapsOnly(6)
Description:	Specifies the type of access allowed to this NMS. Setting this object to none(1) causes the table entry to be destroyed. Read(2) allows access by “get” and “get-next” PDUs. ReadWrite(3) allows access by “set” as well. RoWithtraps(4), rwWithTraps(5), and trapsOnly(6) control distribution of Trap PDUs transmitted by this device.

Interfaces

Variable Name:	docsDevNmAccessInterfaces
Set/Get Response/Status:	Octet String
Description:	Specifies the set of interfaces from which requests from this NMS will be accepted. Each octet within the value of this object specifies a set of 8 interfaces, with the first octet specifying ports 1 through 8, the second octet specifying interfaces 9 through 16, etc. Within each octet, the most significant bit represents the lowest numbered interface, and the least significant bit represents the highest numbered interface. Thus, each interface is represented by a single bit within the value of this object. If that bit has a value of “1” then that interface is included in the set. Note that entries in this table apply only to link-layer interfaces (e.g., Ethernet and CATV MAC). Upstream and downstream channel interfaces must not be specified.

Status

Variable Name:	docsDevNmAccessStatus
Set/Get Response/Status:	RowStatus – active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	Controls and reflects the status of rows in this table.

Docs_Software

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsDevSoftwareInfo table.

Server

Variable Name:	docsDevSwServer
Set/Get Response/Status:	IP Address
Description:	The address of the TFTP server used for software upgrades.

Filename

Variable Name:	docsDevSwFilename
Set/Get Response/Status:	DisplayString (Size (0...64))
Description:	The file name of the software image to be loaded into this device. Unless set via SNMP, this is the file name specified by the provisioning server that corresponds to the software version that is desired for this device. If unknown, the string “(unknown)” is returned.

AdminStatus

Variable Name:	docsDevSwAdminStatus
Set/Get Response/Status:	upgradeFromMgt(1), allowProvisioningUpgrade(2), ignoreProvisioningUpgrade(3)
Description:	If set to upgradeFromMgt(1), the device will initiate a TFTP software image download using docsDevSwFilename. After successfully receiving an image, the device will set its state to ignoreProvisioningUpgrade(3) and reboot. If the download process is interrupted by a reset or power failure, the device will load the previous image and, after reinitialization, continue to attempt loading the image specified in docsDevSwFilename. If set to allowProvisioningUpgrade(2), the device will use the software version information supplied by the provisioning server when next rebooting (this does not cause a reboot). When set to ignoreProvisioningUpgrade(3), the device will disregard software image upgrade information from the provisioning server. Note that reading this object can return upgradeFromMgt(1). This indicates that a software download is currently in progress, and that the device will reboot after successfully receiving an image.

OperStatus

Variable Name:	docsDevSwOperStatus
Set/Get Response/Status:	inProgress(1), completeFromProvisioning(2), completeFromMgt(3), failed(4), other(5)
Description:	InProgress(1) indicates that a TFTP download is underway, either as a result of a version mismatch at provisioning, or as a result of an upgradeFromMgt request. CompleteFromProvisioning(2) indicates that the last software upgrade was a result of version mismatch at provisioning. CompleteFromMgt(3) indicates that the last software upgrade was a result of setting docsDevSwAdminStatus to upgradeFromMgt. Failed(4) indicates that the last attempted download failed, ordinarily due to TFTP timeout.

Docs_Server

This MIB group describes server access and parameters used for initial provisioning and bootstrapping. The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsDevServerInfo table.

BootState

Variable Name:	docsDevServerBootState
Set/Get Response/Status:	operational(1), disabled(2), waitingForDhcpOffer(3), waitingForDhcpResponse(4), waitingForTimeServer(5), waitingForTftp(6), refusedByCmts(7), forwardingDenied(8), other(9), unknown(10)
Description:	If operational(1), the device has completed loading and processing configuration parameters and the CMTS has completed the Registration exchange. If disabled(2), the device was administratively disabled, possibly by being refused network access in the configuration file. If waitingForDhcpOffer(3), then a DHCP Discover has been transmitted and no offer has yet been received. If waitingForDhcpResponse(4), then a DHCP Request has been transmitted and no response has yet been received. If waitingForTime Server(5), then a Time Request has been transmitted and no response has yet been received. If waitingForTftp(6), then a request to the TFTP parameter server has been made and no response received. If refusedByCmts(7), then the Registration Request/Response exchange with the CMTS failed. If forwardingDenied(8), then the registration process completed, but the network access option in the received configuration file prohibits forwarding.

Dhcp

Variable Name:	docsDevServerDhcp
Set/Get Response/Status:	IP Address
Description:	The IP address of the DHCP server that assigned an IP address to this device. Returns 0.0.0.0 if DHCP was not used for IP address assignment.

Time

Variable Name:	docsDevServerTime
Set/Get Response/Status:	IP Address
Description:	The IP address of the Time server (RFC-868).

Tftp

Variable Name:	docsDevServerTftp
Set/Get Response/Status:	IP Address
Description:	The IP address of the TFTP server responsible for downloading provisioning and configuration parameters to this device.

ConfigFile

Variable Name:	docsDevServerConfigFile
Set/Get Response/Status:	DisplayString
Description:	The name of the device configuration file read from the TFTP server.

Docs_EventLog

The Docs_EventLog is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

Event_Info

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsDevEventInfo table.

Control

Variable Name:	docsDevEvControl
Set/Get Response/Status:	resetLog(1), useDefaultReporting(2)
Description:	Setting this object to resetLog(1) empties the event log. All data is deleted. Setting it to useDefaultReporting(2) returns all event priorities to their factory-default reporting. Reading this object always returns useDefaultReporting(2).

Syslog

Variable Name:	docsDevEvSyslog
Set/Get Response/Status:	IP Address
Description:	The IP address of the Syslog server. If 0.0.0.0, syslog transmission is inhibited.

ThrottleAdminStatus

Variable Name:	docsDevEvThrottleAdminStatus
Set/Get Response/Status:	unconstrained(1), maintainBelowThreshold(2), stopAtThreshold(3), inhibited(4)
Description:	Controls the transmission of traps and syslog messages with respect to the trap-pacing threshold. unconstrained(1) causes traps and syslog messages to be transmitted without regard to the threshold settings. maintainBelowThreshold(2) causes trap transmission and syslog messages to be suppressed if the number of traps would otherwise exceed the threshold. stopAtThreshold(3) causes trap transmission to cease at the threshold, and not resume until directed to do so. inhibited(4) causes all trap transmission and syslog messages to be suppressed. A single event is always treated as a single event for threshold counting. That is, an event causing both a trap and a syslog message is still treated as a single event. Writing to this object resets the thresholding state.

ThrottleInhibited

Variable Name:	docsDevEvThrottleInhibited
Set/Get Response/Status:	TruthValue
Description:	If true(1), trap and syslog transmissions are currently inhibited due to thresholds and/or current setting of docsDevEvThrottleAdminStatus.

ThrottleThreshold

Variable Name:	docsDevEvThrottleThreshold
Set/Get Response/Status:	Number
Description:	Number of trap/syslog events per docsDevEvThrottleInterval to be transmitted before throttling. A single event is always treated as a single event for threshold counting. That is, an event causing both a trap and a syslog message is still treated as a single event.

ThrottleInterval

Variable Name:	docsDevEvThrottleInterval
Set/Get Response/Status:	Number
Description:	The interval over which the trap threshold applies.

Event_Control

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsDevEventControl table.

Priority

Variable Name:	docsDevEvPriority
Set/Get Response/Status:	emergency(1), alert(2), critical(3), error(4), warning(5), notice(6), information(7), debug(8)
Description:	The priority level that is controlled by this entry.

Reporting

Variable Name:	docsDevEvReporting
Set/Get Response/Status:	local(0), traps(1), syslog(2)
Description:	Defines the action to be taken on occurrence of this event class. Implementations may not necessarily support all options for all event classes, but at minimum, must allow traps and syslogging to be disabled.

Event_Log

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsDevEventEntry table.

Index

Variable Name:	docsDevEvIndex
Set/Get Response/Status:	Number
Description:	Provides relative ordering of the objects in the event log. This object will always increase except when: a) The log is reset via docsDevEvControl, b) The device reboots and does not implement nonvolatile storage for this log, or c) It reaches the value 2^31. The next entry for all the above cases is 1.

FirstTime

Variable Name:	docsDevEvFirstTime
Set/Get Response/Status:	DateAndTime
Description:	The time that this entry was created.

LastTime

Variable Name:	docsDevEvLastTime
Set/Get Response/Status:	DateAndTime
Description:	If multiple events are reported via the same entry, the time that the last event for this entry occurred.

Count

Variable Name:	docsDevEvCount
Set/Get Response/Status:	Number
Description:	The number of consecutive event instances reported by this entry.

Level

Variable Name:	docsDevEvLevel
Set/Get Response/Status:	emergency(1), alert(2), critical(3), error(4), warning(5), notice(6), information(7), debug(8)
Description:	The priority level of this event.

ID

Variable Name:	docsDevEvId
Set/Get Response/Status:	Number
Description:	For this product, uniquely identifies the type of event that is reported by this entry.

Text

Variable Name:	docsDevEvText
Set/Get Response/Status:	DisplayString
Description:	Provides a human-readable description of the event, including all relevant context (interface numbers, etc.).

Docs_Filters

The Docs_Filters is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

LLC_Filters

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsDevFilterLLCEntry table.

Index

Variable Name:	docsDevFilterLLCIndex
Set/Get Response/Status:	Number
Description:	Index used for the identification of filters (note that LLC filter order is irrelevant).

Status

Variable Name:	docsDevFilterLLCStatus
Set/Get Response/Status:	RowStatus: active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	Controls and reflects the status of rows in this table.

IfIndex

Variable Name:	docsDevFilterLLCIfIndex
Set/Get Response/Status:	Number
Description:	The entry interface to which this filter applies. The value corresponds to ifIndex for either a CATV MAC or another network interface. If the value is zero, the filter applies to all interfaces. In Cable Modems, the default value is the customer side interface. In Cable Modem Termination Systems, this object has to be specified to create a row in this table.

ProtocolType

Variable Name:	docsDevFilterLLCProtocolType
Set/Get Response/Status:	ethertype(1), dsap(2)
Description:	The format of the value in docsDevFilter-LLCProtocol: either a two-byte Ethernet Ethertype, or a one-byte 802.2 SNAP value. EtherType(1) also applies to SNAP-encapsu-lated frames.

Protocol

Variable Name:	docsDevFilterLLCProtocol
Set/Get Response/Status:	Number
Description:	The layer three protocol for which this filter applies. The protocol value format depends on docsDevFilterLLCProtocolType. Note that for SNAP frames, etherType filtering is per-formed rather than DSAP=0xAA.

Matches

Variable Name:	docsDevFilterLLCMatches
Set/Get Response/Status:	Number
Description:	Counts the number of times this filter was matched.

IP_Filters

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsDevFilterIPEntry table.

Index

Variable Name:	docsDevFilterIpIndex
Set/Get Response/Status:	Number
Description:	Index used to order the application of filters. The filter with the lowest index is always applied first.

Status

Variable Name:	docsDevFilterIpStatus
Set/Get Response/Status:	Number
Description:	Controls and reflects the status of rows in this table.

Control

Variable Name:	docsDevFilterIpControl
Set/Get Response/Status:	discard(1), accept(2)
Description:	If set to discard(1), all packets matching this filter will be discarded, and scanning of the remainder of the filter list will be aborted. If set to accept(2), all packets matching this filter will be accepted for further processing (e.g., bridging) and scanning of the remainder of the filter list will be aborted.

IFIndex

Variable Name:	docsDevFilterIpIfIndex
Set/Get Response/Status:	InterfaceIndexOrZero
Description:	The entry interface to which this filter applies. The value corresponds to ifIndex for either a CATV MAC or another network interface. If the value is zero, the filter applies to all interfaces. Default value in Cable Modems is the customer-side interface. In Cable Modem Termination Systems, this object has to be specified to create a row in this table.

Direction

Variable Name:	docsDevFilterIpDirection
Set/Get Response/Status:	inbound(1), outbound(2), both(3)
Description:	Determines whether the filter is applied to inbound(1) traffic, outbound(2) traffic, or traffic in both(3) directions.

Broadcast

Variable Name:	docsDevFilterIpBroadcast
Set/Get Response/Status:	TruthValue
Description:	If set to true(1), the filter only applies to multicast and broadcast traffic. If set to false(2), the filter applies to all traffic.

Saddr

Variable Name:	docsDevFilterIpSaddr
Set/Get Response/Status:	IP Address
Description:	The source IP address, or portion thereof, that is to be matched for this filter.

Smask

Variable Name:	docsDevFilterIpSmask
Set/Get Response/Status:	IP Address
Description:	A bit mask that is to be applied to the source address prior to matching. This mask is not necessarily the same as a subnet mask, but 1's bits must be leftmost and contiguous.

DAddr

Variable Name:	docsDevFilterIpDaddr
Set/Get Response/Status:	IP Address
Description:	The destination IP address, or portion thereof, that is to be matched for this filter.

Dmask

Variable Name:	docsDevFilterIpDmask
Set/Get Response/Status:	IP Address
Description:	A bit mask that is to be applied to the destination address prior to matching. This mask is not necessarily the same as a subnet mask, but 1’s bits must be leftmost and contiguous.

Protocol

Variable Name:	docsDevFilterIpProtocol
Set/Get Response/Status:	icmp(1), tcp(6), udp(17), any(256)
Description:	The IP protocol value that is to be matched.

SourcePortLow

Variable Name:	docsDevFilterIpSourcePortLow
Set/Get Response/Status:	Number
Description:	If docsDevFilterIpProtocol is udp or tcp, this is the inclusive lower boundary of the transport-layer source port range that is to be matched.

SourcePortHigh

Variable Name:	docsDevFilterIpSourcePortHigh
Set/Get Response/Status:	Number
Description:	If docsDevFilterIpProtocol is udp or tcp, this is the inclusive upper boundary of the transport-layer source port range that is to be matched.

DestPortLow

Variable Name:	docsDevFilterIpDestPortLow
Set/Get Response/Status:	Number
Description:	If docsDevFilterIpProtocol is udp or tcp, this is the inclusive lower boundary of the transport-layer destination port range that is to be matched.

DestPortHigh:

Variable Name:	docsDevFilterIpDestPortHigh
Set/Get Response/Status:	Number
Description:	If docsDevFilterIpProtocol is udp or tcp, this is the inclusive upper boundary of the transport-layer destination port range that is to be matched.

Matches

Variable Name:	docsDevFilterIpMatches
Set/Get Response/Status:	Number
Description:	Counts the number of times this filter was matched.

DocsIF

DocsIF is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings. All of which reside under the MIB variable table name DocsIFMIBObjects.

DocsIfBase

DocsIfBase is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

IfDownstreamChannelEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfDownstreamChannelEntry table.

The following table is implemented on both the Cable Modem and the Cable Modem Termination System.

This table provides a list of attributes for a single Downstream channel. An entry in this table exists for each ifEntry with an ifType of docsCable-Downstream(128).

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

Id

Variable Name:	docsIfDownChannelId
Set/Get Response/Status:	Number
Description:	The CMTS identification of the downstream channel within this particular MAC interface. If the interface is down, the object returns the most current value. If the downstream channel ID is unknown, this object returns a value of 0.

Frequency

Variable Name:	docsIfDownChannelFrequency
Set/Get Response/Status:	Number (Hertz)
Description:	The center of the downstream frequency associated with this channel. This object will return the current tuner frequency. If a CMTS provides IF output, this object will return 0, unless this CMTS is in control of the final downstream RF frequency.

Width

Variable Name:	docsIfDownChannelWidth
Set/Get Response/Status:	Number (Hertz)
Description:	The bandwidth of this downstream channel. Most implementations are expected to support a channel width of 6 MHz (North America) and/or 8 MHz (Europe).

Modulation

Variable Name:	docsIfDownChannelModulation
Set/Get Response/Status:	unknown(1), other(2), qam64(3), qam256(4)
Description:	The modulation type associated with this downstream channel. If the interface is down, this object either returns the configured value (CMTS), the most current value (CM), or the value of unknown(1).

Interleave

Variable Name:	docsIfDownChannelInterleave
Set/Get Response/Status:	unknown(1), other(2), taps8Increment16(3), taps16Increment8(4), taps32Increment4(5), taps64Increment2(6), taps128Increment1(7)
Description:	The Forward Error Correction (FEC) interleaving used for this downstream channel. Values are defined as follows:

taps8Increment16(3):	protection 5.9/4.1 usec, latency .22/.15 msec
taps16Increment8(4):	protection 12/8.2 usec, latency .48/.33 msec
taps32Increment4(5):	protection 24/16 usec, latency .98/.68 msec
taps64Increment2(6):	protection 47/33 usec, latency 2/1.4 msec
taps128Increment1(7):	protection 95/66 usec, latency 4/2.8 msec

If the interface is down, this object either returns the configured value (CMTS), the most current value (CM), or the value of unknown(1). The value of other(2) is returned if the interleave is known but not defined in the above list.

Power

Variable Name:	docsIfDownChannelPower
Set/Get Response/Status:	Number (TenthdBmV)
Description:	At the CMTS, the operational transmit power. At the CM, the received power level. May be set to zero at the CM if power level measurement is not supported. If the interface is down, this object either returns the configured value (CMTS), the most current value (CM) or the value of 0.

IfUpstreamChannelEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfUpstreamChannelEntry table.

The following table is implemented on both the Cable Modem and the Cable Modem Termination System.

This table provides a list of attributes for a single upstream channel. An entry in this table exists for each ifEntry with an ifType of docsCableUpstream(129).

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the entity's network management system to the next reinitialization.

Id

Variable Name:	docsIfUpChannelId
Set/Get Response/Status:	Number
Description:	The CMTS identification of the upstream channel.

Frequency

Variable Name:	docsIfUpChannelFrequency
Set/Get Response/Status:	Number (Hertz)
Description:	The center of the frequency band associated with this upstream channel. This object returns 0 if the frequency is undefined or unknown. Minimum permitted upstream frequency is 5,000,000 Hz.

Width

Variable Name:	docsIfUpChannelWidth
Set/Get Response/Status:	Number (Hertz)
Description:	The bandwidth of this upstream channel. This object returns 0 if the channel width is undefined or unknown. Minimum permitted channel width is 160,000 Hz.

ModulationProfile

Variable Name:	docsIfUpChannelModulationProfile
Set/Get Response/Status:	Number
Description:	An entry identical to the docsIfModIndex in the docsIfCmtsModulationTable that describes this channel. This channel is further instantiated there by a grouping of interval usage codes which together fully describe the channel modulation. This object returns 0 if the docsIfCmtsModulationTable does not exist or is empty.

SlotSize

Variable Name:	docsIfUpChannelSlotSize
Set/Get Response/Status:	Number
Description:	The number of 6.25 microsecond ticks in each upstream mini-slot. Returns zero if the value is undefined or unknown.

TxTimingOffset

Variable Name:	docsIfUpChannelTxTimingOffset
Set/Get Response/Status:	Number
Description:	A measure of the current round trip time at the CM, or the maximum round trip time seen by the CMTS. Used for timing of CM upstream transmissions to ensure synchronized arrivals at the CMTS. Units are in terms of (6.25 microseconds/64).

RangingBackoffStart

Variable Name:	docsIfUpChannelRangingBackoffStart
Set/Get Response/Status:	Number (0-16)
Description:	The initial random backoff window to use when retrying Ranging Requests. Expressed as a power of 2. A value of 16 at the CMTS indicates that a proprietary adaptive retry mechanism is to be used.

RangingBackoffEnd

Variable Name:	docsIfUpChannelRangingBackoffEnd
Set/Get Response/Status:	Number (0-16)
Description:	The final random backoff window to use when retrying Ranging Requests. Expressed as a power of 2. A value of 16 at the CMTS indicates that a proprietary adaptive retry mechanism is to be used.

TxBackoffStart

Variable Name:	docsIfUpChannelTxBackoffStart
Set/Get Response/Status:	Number (0-16)
Description:	The initial random backoff window to use when retrying transmissions. Expressed as a power of 2. A value of 16 at the CMTS indicates that a proprietary adaptive retry mechanism is to be used.

TxBackoffEnd

Variable Name:	docsIfUpChannelTxBackoffEnd
Set/Get Response/Status:	Number (0-16)
Description:	The final random backoff window to use when retrying transmissions. Expressed as a power of 2. A value of 16 at the CMTS indicates that a proprietary adaptive retry mechanism is to be used.

IfQosProfileEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfQosProfileEntry table.

The table describes the attributes of each class of service. The entries in this table are referenced from the docsIfServiceEntries. They exist as a separate table in order to reduce redundant information in docsIfServiceTable.

This table is implemented at both the CM and the CMTS. The CM need only maintain entries for the classes of service referenced by its docsIfServiceTable.

Index

Variable Name:	docsIfQosProfIndex
Set/Get Response/Status:	Number
Description:	The index value that uniquely identifies an entry. The index value which uniquely identifies an entry in the docsIfQosProfileTable.

Priority

Variable Name:	docsIfQosProfPriority
Set/Get Response/Status:	Number (0-7)
Description:	A relative priority assigned to this service when allocating bandwidth. Zero indicates lowest priority; seven highest. Interpretation of priority is device-specific.

MaxUpBandwidth

Variable Name:	docsIfQosProfMaxUpBandwidth
Set/Get Response/Status:	Number
Description:	The maximum upstream bandwidth, in bits per second, allowed for a service with this service class. Zero, if there is no restriction of upstream bandwidth.

GuarUpBandwidth

Variable Name:	docsIfQosProfGuarUpBandwidth
Set/Get Response/Status:	Number
Description:	Minimum guaranteed upstream bandwidth, in bits per second, allowed for a service with this service class.

MaxDownBandwidth

Variable Name:	docsIfQosProfMaxDownBandwidth
Set/Get Response/Status:	Number
Description:	The maximum downstream bandwidth, in bits per second, allowed for a service with this service class. Zero, if there is no restriction of downstream bandwidth.

MaxTxBurst

Variable Name:	docsIfQosProfMaxTxBurst
Set/Get Response/Status:	Number
Description:	The maximum number of mini-slots that may be requested for a single upstream transmission. A value of zero means there is no limit.

BaselinePrivacy

Variable Name:	docsIfQosProfBaselinePrivacy
Set/Get Response/Status:	TruthValue
Description:	Indicates whether Baseline Privacy is enabled for this service class.

Status

Variable Name:	docsIfQosProfStatus
Set/Get Response/Status:	RowStatus: active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	Controls and reflects the status of rows in this table.

IfSignalQualityEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsIfSignalQualityEntry table.

The table at the CM describes the PHY characteristics of a downstream channel. At the CMTS, the table describes the PHY signal quality of an upstream channel. An entry in this table exists for each ifEntry, with an ifType of docsCableUpstream(129) for Cable Modem Termination Systems, and docsCableDownstream(128) for Cable Modems.

Index

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value for each interface must remain constant at least from one reinitialization of the entity's network management system to the next reinitialization.

IncludesContention

Variable Name:	docsIfSigQIncludesContention
Set/Get Response/Status:	TruthValue
Description:	True(1) if this CMTS includes contention intervals in the counters in this table. Always False(2) for CMs.

Unerroreds

Variable Name:	docsIfSigQUnerroreds
Set/Get Response/Status:	Number
Description:	Codewords received on this channel without error. This includes all codewords, whether or not they were part of frames destined for this device.

Correcteds

Variable Name:	docsIfSigQCorrecteds
Set/Get Response/Status:	Number
Description:	Codewords received on this channel with correctable errors. This includes all codewords, whether or not they were part of frames destined for this device.

Uncorrectables

Variable Name:	docsIfSigQUncorrectables
Set/Get Response/Status:	Number
Description:	Codewords received on this channel with uncorrectable errors. This includes all codewords, whether or not they were part of frames destined for this device.

SignalNoise

Variable Name:	docsIfSigQSignalNoise
Set/Get Response/Status:	Number
Description:	Signal/Noise ratio as perceived for this channel. Only meaningful in Cable Modems. Returns zero for Cable Modem Termination Systems.

Microreflections

Variable Name:	docsIfSigQMicroreflections
Set/Get Response/Status:	Number (dBc)
Description:	Total microreflections including in-channel response as perceived on this interface, measured in dBc below the signal level. This object is not assumed to return an absolutely accurate value, but should give a rough indication of microreflections received on this interface. It is up to the implementor to provide information as accurately as possible.

DocsIfCM

DocsIfCM is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

IfCmMacEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmMacEntry table.

An entry contains objects describing attributes of each MAC entry, extending the information in ifEntry. An entry in this table exists for each ifEntry with an ifType of docsCableMaclayer(127).

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

CmtsAddress

Variable Name:	docsIfCmCmtsAddress
Set/Get Response/Status:	MacAddress
Description:	Identifies the CMTS that is believed to control this MAC domain. At the CM, this will be the source address from SYNC, MAP, and other MAC-layer messages. If the CMTS is unknown, returns 00-00-00-00-00-00.

Capabilities

Variable Name:	docsIfCmCapabilities
Set/Get Response/Status:	Bits (Hex): atmCells(0), concatenation(1)
Description:	Identifies the capabilities of the MAC implementation at this interface. Note that packet transmission is always supported. Therefore, there is no specific bit required to explicitly indicate this capability.

RangingRespTimeout

Variable Name:	docsIfCmRangingRespTimeout
Set/Get Response/Status:	Number (TimeTicks)
Description:	Waiting time for a Ranging Response packet. REFERENCE Data over Cable Radio Frequency Interface specification, Section 7, timer T3.

ifCmStatusEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmStatusEntry table.

This table is implemented only at the CM, and maintains a number of status objects and counters for Cable Modems. This table includes a set of status objects and counters for a single MAC layer instance in a Cable Modem. An entry in this table exists for each ifEntry with an ifType of docsCableMaclayer(127).

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

Value

Variable Name:	docsIfCmStatusValue
Set/Get Response/Status:	Number: other(1), notReady(2), notSynchronized(3), phySynchronized(4), usParametersAcquired(5), rangingComplete(6), ipComplete(7), todEstablished(8), securityEstablished(9), paramTransferComplete(10), registrationComplete(11), operational(12), accessDenied(13)
Description:	Current Cable Modem connectivity state, as specified in the RF Interface Specification. REFERENCE Data over Cable Radio Frequency Interface Specification, Chapter 7.2.

Code

Variable Name:	docsIfCmStatusCode
Set/Get Response/Status:	Number (OctetString)
Description:	Status code for this Cable Modem as defined in the RF Interface Specification. The status code consists of a single character indicating error groups, followed by a two- or three-digit number indicating the status condition. REFERENCE Data over Cable Radio Frequency Interface Specification, Cable Modem status codes.

TxPower

Variable Name:	docsIfCmStatusTxPower
Set/Get Response/Status:	Number (TenthdBmV)
Description:	The operational transmit power for the attached upstream channel.

Resets

Variable Name:	docsIfCmStatusResets
Set/Get Response/Status:	Number
Description:	Number of times the CM reset or initialized this interface.

LostSyncs

Variable Name:	docsIfCmStatusLostSyncs
Set/Get Response/Status:	Number
Description:	Number of times the CM lost synchronization with the downstream channel.

InvalidMaps

Variable Name:	docsIfCmStatusInvalidMaps
Set/Get Response/Status:	Number
Description:	Number of times the CM received invalid MAP messages.

InvalidUcds

Variable Name:	docsIfCmStatusInvalidUcds
Set/Get Response/Status:	Number
Description:	Number of times the CM received invalid UCD messages.

InvalidRangingResp

Variable Name:	docsIfCmStatusInvalidRangingResp
Set/Get Response/Status:	Number
Description:	Number of times the CM received invalid ranging response messages.

InvalidRegistrationResp

Variable Name:	docsIfCmStatusInvalidRegistrationResp
Set/Get Response/Status:	Number
Description:	Number of times the CM received invalid registration response messages.

T1Timeouts

Variable Name:	docsIfCmStatusT1Timeouts
Set/Get Response/Status:	Number
Description:	Number of times counter T1 expired in the CM.

T2Timeouts

Variable Name:	docsIfCmStatusT2Timeouts
Set/Get Response/Status:	Number
Description:	Number of times counter T2 expired in the CM.

T3Timeouts

Variable Name:	docsIfCmStatusT3Timeouts
Set/Get Response/Status:	Number
Description:	Number of times counter T3 expired in the CM.

T4Timeouts

Variable Name:	docsIfCmStatusT4Timeouts
Set/Get Response/Status:	Number
Description:	Number of times counter T4 expired in the CM.

RangingAborteds

Variable Name:	docsIfCmStatusRangingAborteds
Set/Get Response/Status:	Number
Description:	Number of times the ranging process was aborted by the CMTS.

ifCmServiceEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmServiceEntry table.

The attributes are described for each upstream service queue on a CM. Describes the attributes of an upstream bandwidth service queue. An entry in this table exists for each Service ID. The primary index is an ifIndex with an ifType of docsCableMaclayer(127).

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

Id

Variable Name:	docsIfCmServiceId
Set/Get Response/Status:	Number
Description:	Identifies a service queue for upstream bandwidth. The attributes of this service queue are shared between the CM and the CMTS. The CMTS allocates upstream bandwidth to this service queue based on requests from the CM and on the class of service associated with this queue.

QosProfile

Variable Name:	docsIfCmServiceQosProfile
Set/Get Response/Status:	Number
Description:	The index in docsIfQosProfileTable describing the quality of service attributes associated with this particular service.

TxSlotsImmed

Variable Name:	docsIfCmServiceTxSlotsImmed
Set/Get Response/Status:	Number
Description:	The number of upstream mini-slots that have been used to transmit data PDUs in immediate (contention) mode. This includes only those PDUs that are presumed to have arrived at the headend (i.e., those that were explicitly acknowledged). It does not include retransmission attempts or mini-slots used by Requests.

TxSlotsDed

Variable Name:	docsIfCmServiceTxSlotsDed
Set/Get Response/Status:	Number
Description:	The number of upstream mini-slots that have been used to transmit data PDUs in dedicated mode (i.e., as a result of a unicast Data Grant).

TxRetries

Variable Name:	docsIfCmServiceTxRetries
Set/Get Response/Status:	Number
Description:	The number of attempts to transmit data PDUs containing requests for acknowledgment which did not result in acknowledgment.

TxExceeded

Variable Name:	docsIfCmServiceTxExceeded
Set/Get Response/Status:	Number
Description:	The number of data PDUs transmission failures due to excessive retries without acknowledgment.

RqRetries

Variable Name:	docsIfCmServiceRqRetries
Set/Get Response/Status:	Number
Description:	The number of attempts to transmit bandwidth requests which did not result in acknowledgment.

RqExceeded

Variable Name:	docsIfCmServiceRqExceeded
Set/Get Response/Status:	Number
Description:	The number of requests for bandwidth which failed due to excessive retries without acknowledgment.

ifCmtsMacEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmtsMacEntry table.

This describes the attributes of each CMTS MAC interface, extending the information available from ifEntry. It is mandatory for all CMTS devices. An entry containing objects describing attributes of each MAC entry, which extends the information in ifEntry. An entry in this table exists for each ifEntry with an ifType of docsCableMaclayer(127).

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

Capabilities

Variable Name:	docsIfCmtsCapabilities
Set/Get Response/Status:	Bits (Hex): atmCells(0), concatenation(1)
Description:	Identifies the capabilities of the CMTS MAC implementation at this interface. Note that packet transmission is always supported. Therefore, there is no specific bit required to explicitly indicate this capability.

SyncInterval

Variable Name:	docsIfCmtsSyncInterval
Set/Get Response/Status:	Number (Milliseconds)
Description:	The interval between CMTS transmission of successive SYNC messages at this interface. REFERENCE Data Over Cable Radio Frequency Interface Specification, Sync Interval.

UcdInterval

Variable Name:	docsIfCmtsUcdInterval
Set/Get Response/Status:	Number (Milliseconds)
Description:	The interval between CMTS transmission of successive Upstream Channel Descriptor messages for each upstream channel at this interface. REFERENCE Data Over Cable Radio Frequency Interface Specification, UCD Interval.

MaxServiceIds

Variable Name:	docsIfCmtsMaxServiceIds
Set/Get Response/Status:	Number
Description:	The maximum number of service IDs that may be simultaneously active.

InsertionInterval

Variable Name:	docsIfCmtsInsertionInterval
Set/Get Response/Status:	Number (TimeTicks)
Description:	The amount of time to elapse between each broadcast station maintenance grant. Broadcast station maintenance grants are used to allow new cable modems to join the network. Zero indicates that a vendor-specific algorithm is used instead of a fixed time. Maximum amount of time permitted by the specification is two seconds. REFERENCE Data Over Cable Radio Frequency Interface Specification, Ranging Interval.

InvitedRangingAttempts

Variable Name:	docsIfCmtsInvitedRangingAttempts
Set/Get Response/Status:	Number
Description:	The maximum number of attempts to make on invitations for ranging requests. A value of zero means the system should attempt to range forever.

ifCmtsStatusEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmtsStatusEntry table.

For the MAC layer, this group maintains a number of status objects and counters. It includes the Status entry for a single MAC layer. An entry in this table exists for each ifEntry with an ifType of docsCableMaclayer(127).

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

InvalidRangeReqs

Variable Name:	docsIfCmtsStatusInvalidRangeReqs
Set/Get Response/Status:	Number
Description:	This object counts invalid RNG-REQ messages received on this interface.

RangingAborteds

Variable Name:	docsIfCmtsStatusRangingAborteds
Set/Get Response/Status:	Number
Description:	This object counts ranging attempts that were explicitely aborted by the CMTS.

InvalidRegReqs

Variable Name:	docsIfCmtsStatusInvalidRegReqs
Set/Get Response/Status:	Number
Description:	This object counts invalid REG-REQ messages received on this interface.

FailedRegReqs

Variable Name:	docsIfCmtsStatusFailedRegReqs
Set/Get Response/Status:	Number
Description:	This object counts failed registration attempts, i.e., authentication failures and class-of-service failures, on this interface.

InvallidDataReqs

Variable Name:	docsIfCmtsStatusInvalidDataReqs
Set/Get Response/Status:	Number
Description:	This object counts invalid data request messages received on this interface.

T5Timeouts

Variable Name:	docsIfCmtsStatusT5Timeouts
Set/Get Response/Status:	Number
Description:	This object counts the number of times counter T5 expired on this interface.

ifCmtsCmStatus

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmtsCmStatus table.

This table is implemented only at the CMTS. It contains per CM status information available in the CMTS. The table contains a set of objects in the CMTS, maintained for each Cable Modem connected to this CMTS. It contains status information for a single Cable Modem. An entry in this table exists for each Cable Modem that is connected to the CMTS implementing this table.

Index

Variable Name:	docsIfCmtsCmStatusIndex
Set/Get Response/Status:	Number
Description:	Index value to uniquely identify an entry in this table. For an individual Cable Modem, this index value should not change during CMTS uptime.

MacAddress

Variable Name:	docsIfCmtsCmStatusMacAddress
Set/Get Response/Status:	MacAddress
Description:	MAC address of this Cable Modem. If the Cable Modem has multiple MAC addresses, this is the MAC address associated with the Cable interface.

IpAddress

Variable Name:	docsIfCmtsCmStatusIpAddress
Set/Get Response/Status:	IpAddress
Description:	IP address of this Cable Modem. If the Cable Modem has no IP address assigned, or the IP address is unknown, this object returns a value of 0.0.0.0. If the Cable Modem has multiple IP addresses, this object returns the IP address associated with the Cable interface.

DownChannelIfIndex

Variable Name:	docsIfCmtsCmStatusDownChannelIfIndex
Set/Get Response/Status:	Number (InterfaceIndexOrZero)
Description:	IfIndex of the downstream channel to which this CM is connected. If the downstream channel is unknown, this object returns a value of zero.

UpChannelIfIndex

Variable Name:	docsIfCmtsCmStatusUpChannelIfIndex
Set/Get Response/Status:	Number (InterfaceIndexOrZero)
Description:	IfIndex of the upstream channel to which this CM is connected. If the upstream channel is unknown, this object returns a value of zero.

RxPower

Variable Name:	docsIfCmtsCmStatusRxPower
Set/Get Response/Status:	Number (TenthdBmV)
Description:	The receive power as percieved for upstream data from this Cable Modem. If the receive power is unknown, this object returns a value of zero.

TimingOffset

Variable Name:	docsIfCmtsCmStatusTimingOffset
Set/Get Response/Status:	Number
Description:	A measure of the current round trip time for this CM. Used for timing of CM upstream transmissions to ensure synchronized arrivals at the CMTS. Units are in terms of (6.25 microseconds/64). Returns zero if the value is unknown.

EqualizationData

Variable Name:	docsIfCmtsCmStatusEqualizationData
Set/Get Response/Status:	Number (Hex)
Description:	Equalization data for this CM. Returns an empty string if the value is unknown, or if there is no equalization data available or defined. REFERENCE Data Over Cable Radio Frequency Interface Specification, Figure 6-22.

Value

Variable Name:	docsIfCmtsCmStatusValue
Set/Get Response/Status:	Number: other(1), ranging(2), rangingAborted(3), rangingComplete(4), ipComplete(5), registrationComplete(6), accessDenied(7)
Description:	Current Cable Modem connectivity state, as specified in the RF Interface Specification. Returned status information is the CM status as assumed by the CMTS, and indicates the following events: other(1): Any state other than below. ranging(2): The CMTS has received an Initial Ranging Request message from the CM, and the ranging process is not yet complete. rangingAborted(3): The CMTS has sent a Ranging Abort message to the CM. rangingComplete(4): The CMTS has sent a Ranging Complete message to the CM. ipComplete(5): The CMTS has received a DHCP reply message and forwarded it to the CM. registrationComplete(6): The CMTS has sent a Registration Response message to the CM. accessDenied(7): The CMTS has sent a Registration Aborted message to the CM. The CMTS only needs to report states it is able to detect. REFERENCE Data Over Cable Radio Frequency Interface Specification, Chapter 7.2.

IfCmtsServiceEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmtsServiceEntry table.

It describes the attributes of upstream service queues in a Cable Modem Termination System, as well as the attributes of a single upstream bandwidth service queue.

An entry in this table exists for each Service ID. The primary index is an ifIndex with an ifType of docsCableMaclayer(127). Entries in this table are created with the creation of individual Service IDs by the MAC layer and removed when a Service ID is removed.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant, at least from one reinitialization of the emtity's network management system to the next reinitialization.

Id

Variable Name:	docsIfCmtsServiceId
Set/Get Response/Status:	Number
Description:	Identifies a service queue for upstream bandwidth. The attributes of this service queue are shared between the Cable Modem and the Cable Modem Termination System. The CMTS allocates upstream bandwidth to this service queue based on requests from the CM and on the class of service associated with this queue.

CmStatusIndex

Variable Name:	docsIfCmtsServiceCmStatusIndex
Set/Get Response/Status:	Number
Description:	Pointer to an entry in docsIfCmtsCmStatus-Table identifying the Cable Modem using this Service Queue. If multiple Cable Modems are using this Service Queue, the value of this object is zero.

AdminStatus

Variable Name:	docsIfCmtsServiceAdminStatus
Set/Get Response/Status:	Number: enabled(1), disabled(2), destroyed(3)
Description:	Allows a service class for a particular modem to be suppressed, (re-)enabled, or deleted altogether.

QosProfile

Variable Name:	docsIfCmtsServiceQosProfile
Set/Get Response/Status:	Number
Description:	The index in docsIfQosProfileTable describing the quality of service attributes associated with this particular service.

CreateTime

Variable Name:	docsIfCmtsServiceCreateTime
Set/Get Response/Status:	Number (TimeTicks)
Description:	The value of sysUpTime when this entry was created.

InOctets

Variable Name:	docsIfCmtsServiceInOctets
Set/Get Response/Status:	Number
Description:	The cumulative number of Packet Data octets received on this Service ID. The count does not include the size of the Cable MAC header.

InPackets

Variable Name:	docsIfCmtsServiceInPackets
Set/Get Response/Status:	Number
Description:	The cumulative number of Packet Data packets received on this Service ID.

IfCmtsModulationEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmtsModulationEntry table.

The following table provides upstream channel modulation profiles. Entries in this table can be reused by one or more upstream channels. An upstream channel will have a modulation profile for each value of docsIf-ModIntervalUsageCode.

Index

Variable Name:	docsIfCmtsModIndex
Set/Get Response/Status:	Number
Description:	An index into the Channel Modulation table representing a group of Interval Usage Codes, all associated with the same channel.

IntervalUsageCode

Variable Name:	docsIfCmtsModIntervalUsageCode
Set/Get Response/Status:	Number: request(1), requestData(2), initial-Ranging(3), periodicRanging(4), short-Data(5), longData(6)
Description:	An index into the Channel Modulation table, which, when grouped with other Interval Usage Codes, fully instantiates all modula-tion sets for a given upstream channel.

Control

Variable Name:	docsIfCmtsModControl
Set/Get Response/Status:	RowStatus: active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	Controls and reflects the status of rows in this table.

Type

Variable Name:	docsIfCmtsModType
Set/Get Response/Status:	Number: other(1), qpsk(2), qam16(3)
Description:	The modulation type used on this channel.

PreambleLen

Variable Name:	docsIfCmtsModPreambleLen
Set/Get Response/Status:	Number
Description:	The preamble length for this modulation profile in bits. Default value is the minimum needed by the implementation at the CMTS for the given modulation profile.

DifferentialEncoding

Variable Name:	docsIfCmtsModDifferentialEncoding
Set/Get Response/Status:	TruthValue
Description:	Specifies whether or not differential encoding is used on this channel.

FECErrorCorrection

Variable Name:	docsIfCmtsModFECErrorCorrection
Set/Get Response/Status:	Number
Description:	The number of correctable errored bytes (t) used in forward error correction code. The value of 0 indicates no correction is employed. The number of check bytes appended will be twice this value.

FECCodewordLength

Variable Name:	docsIfCmtsModFECCodewordLength
Set/Get Response/Status:	Number
Description:	The number of data bytes (k) in the forward error correction codeword. This object is not used if docsIfCmtsModFECErrorCorrection is zero.

ScramblerSeed

Variable Name:	docsIfCmtsModScramblerSeed
Set/Get Response/Status:	Number
Description:	The 15 bit seed value for the scrambler polynomial.

MaxBurstSize

Variable Name:	docsIfCmtsModMaxBurstSize
Set/Get Response/Status:	Number
Description:	The maximum number of mini-slots that can be transmitted during this channel's burst time. Returns zero if the burst length is bounded by the allocation MAP rather than this profile. Default value is 0 except for shortData, where it is 8.

GuardTimeSize

Variable Name:	docsIfCmtsModGuardTimeSize
Set/Get Response/Status:	Number
Description:	The number of symbol-times which must follow the end of this channel's burst. Default value is the minimum time needed by the implementation for this modulation profile.

LastCodewordShortened

Variable Name:	docsIfCmtsModLastCodewordShortened
Set/Get Response/Status:	TruthValue
Description:	Indicates if the last FEC codeword is truncated.

Scrambler

Variable Name:	docsIfCmtsModScrambler
Set/Get Response/Status:	TruthValue
Description:	Indicates if the scrambler is employed.

IfCmtsObjectsInfo

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmtsObjectsInfo table.

docsIfCmtsQosProfilePermissions

Variable Name:	docsIfCmtsQosProfilePermissions
Set/Get Response/Status:	Number: createByManagement(0), updateByManagement(1), createByModems(2)
Description:	This object specifies permitted methods of creating entries in docsIfQosProfileTable. createByManagement(0) is set if entries can be created using SNMP. updateByManagement(1) is set if updating entries using SNMP is permitted. createByModems(2) is set if entries can be created based on information in REG-REQ MAC messages received from cable modems. Information in this object is only applicable if docsIfQosProfileTable is implemented as read-create. Otherwise, this object is implemented as read-only and returns createByModems(2). Either createByManagement(0) or createByModems(1) must be set when writing to this object.

lancityMcnsMib

lancityMcnsMib is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings. All of which reside under the MIB variable table name lancityMcnsMib.

lccmtsif

lccmtsif is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

LcCmtsUpstreamEntry

This MIB tale defines properties of upstream channels from the CMTS.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the docsIfCmtsObjectsInfo table.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant, at least from one reinitialization of the emtity's network management system to the next reinitialization.

MinimumMapSize

Variable Name:	lcCmtsUpMinimumMapSize
Set/Get Response/Status:	Number
Description:	Minimum number of slots to be mapped in each Map PDU.

MaximumMapSize

Variable Name:	lcCmtsUpMaximumMapSize
Set/Get Response/Status:	Number
Description:	Maximum number of slots to be mapped in each Map PDU.

ContentionPerMap

Variable Name:	lcCmtsUpContentionPerMap
Set/Get Response/Status:	Number
Description:	The number of mini-slots allotted to contention (REQ or REQ-DATA) per MAP PDU.

RequestDataAllowed

Variable Name:	lcCmtsUpRequestDataAllowed
Set/Get Response/Status:	Number: allowed(1), disallowed(2), adaptive(3)
Description:	Specifies whether or not the CMTS will allow contention data on this upstream interface.

MaxDatainContention

Variable Name:	lcCmtsUpMaxDataInContention
Set/Get Response/Status:	Number
Description:	The number of mini-slots that may be used for a single upstream contention transmission.

InitialRangingInterval

Variable Name:	lcCmtsUpInitialRangingInterval
Set/Get Response/Status:	Number – microseconds
Description:	The duration, in microseconds, of the initial ranging interval. This interval is used by unranged modems to enter the network, and so must be long enough to admit the most distant modem.

HighPriorityThreshold

Variable Name:	lcCmtsUpHighPriorityThreshold
Set/Get Response/Status:	Number
Description:	Weighting of high priority queue vis-a-vis normal priority queue.

GuaranteedThreshold

Variable Name:	lcCmtsUpGuaranteedThreshold
Set/Get Response/Status:	Number
Description:	Permitted aggregate CIR, as a percentage of the overall channel bandwidth.

PublicationDelay

Variable Name:	lcCmtsUpPublicationDelay
Set/Get Response/Status:	Number - microseconds
Description:	A sum of architectural constants, parameters, and network status (RTD) that governs the difference between the publication time of the MAP and its effectiveness.

NFlowControlledMaps

Variable Name:	lcCmtsUpNFlowControlledMaps
Set/Get Response/Status:	Number
Description:	The number of Map PDUs that were generated under flow-controlled (prioritized) conditions.

NNonFlowControlledMaps

Variable Name:	lcCmtsUpNNonFlowControlledMaps
Set/Get Response/Status:	Number
Description:	The number of Map PDUs that were generated under FIFO conditions.

lccmtsifInfo

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the lccmtsifInfo table.

CurrentTemp

Variable Name:	lcCmtsCurrentTemp
Set/Get Response/Status:	Number
Description:	Current temperature of a CMTS device in degrees Celsius.

HighTempThreshold

Variable Name:	lcCmtsHighTempThreshold
Set/Get Response/Status:	Number
Description:	High temperature threshold limit of a CMTS device in degrees Celsius, above which an event occurs to signal that the threshold has been exceeded. The device temperature is read once per minute and compared to this threshold value. A trap is sent out if the event's priority indicates that a trap is to be sent (refer to the docsDevEvControlTable object in DOCS-CABLE-DEVICE-MIB). The priority of this event is critical(3).

lccmtsdevice

lccmtsdev is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

LcCmtsProvisioningInfo

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the LcCmtsProvisioningInfo table.

ProvisioningControl

Variable Name:	lcProvisioningControl	
Set/Get Response/Status:	Number: use-dhcp-and-tftp(1), use-dhcp(2), use-tftp(3), use-nvram(4)	
Description:	Controls the use of file-based provisioning by the CMTS. If set to:	
	use-dhcp-and-tftp(1)	The CMTS will use DHCP to find its IP address, subnet mask, default router, and TFTP server. Configuration parameters will be provisioned from a TFTPed parameter file.
	use-dhcp(2)	DHCP will be used to find the IP address, subnet mask, and default router, but all other parameters will come from NVRAM.

use-tftp(3)	The CMTS will use NVRAM for its IP address, but other configured parameters will be loaded via TFTP.
use-nvram(4)	All operational parameters are taken from nonvolatile RAM.

ConfigIpAddress

Variable Name:	lcConfigIpAddress
Set/Get Response/Status:	IP Address
Description:	The IP address of the CMTS; provides a writable equivalent of ipAdEntAddr. If set to null (0.0.0.0), the address must be provided through DHCP.

ConfigIpSubnet

Variable Name:	lcConfigIpSubnet
Set/Get Response/Status:	IP Address
Description:	The subnet mask corresponding to lcConfigIpAddress; provides a writable equivalent of ipAdEntNetMask.

ConfigTftpAddress

Variable Name:	lcConfigTftpAddress
Set/Get Response/Status:	IP Address
Description:	The IP address of the TFTP server supplying provisioning configuration data.

ConfigTftpFilename

Variable Name:	lcConfigTftpFilename
Set/Get Response/Status:	DisplayString
Description:	The default filename on the TFTP server for acquiring provisioning configuration data (may be overridden by DHCP).

LcSerialPortEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the LcSerialPortEntry table.

Number

Variable Name:	lcSerialPortNumber
Set/Get Response/Status:	Number
Description:	Index for this table.

BaudRate

Variable Name:	lcSerialPortBaudRate
Set/Get Response/Status:	Number – baudrate1200b(1200), baudrate2400b(2400), baudrate4800b(4800), baudrate7200b(7200), baudrate9600b(9600), baudrate12000b(12000), baudrate14400b(14400), baudrate19200b(19200), baudrate28800b(28800), baudrate38k(38400), baudrate56k(57600), baudrate64k(64000), baudrate76k(76800), baudrate96k(96000), baudrate115k(115200)
Description:	Baud rate configured on this Serial Port.

DataBits

Variable Name:	lcSerialPortDataBits
Set/Get Response/Status:	Number
Description:	Number of data bits configured on this Serial Port.

Parity

Variable Name:	lcSerialPortParity
Set/Get Response/Status:	Number: none(1), odd(2), even(3)
Description:	Type of parity configured on this Serial Port.

StopBits

Variable Name:	lcSerialPortStopBits
Set/Get Response/Status:	Number: s1bit(1), s15bit(2), s2bit(3)
Description:	Number of stop bits configured on this Serial Port.

ModemEnable

Variable Name:	lcSerialPortModemEnable
Set/Get Response/Status:	Number: enabled(1), disabled(2)
Description:	Enable the Serial Port to run with modem leads enabled.

LcModemVendorEntry

This table defines modems which are allowed to register with this CMTS. Modem vendors are identified by the OUI portion of the MAC address used by the modem for registration. In order to allow further differentiation based on particular models, the entire MAC address may be masked and used to screen registrations.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the LcModemVendorEntry table.

Index

Variable Name:	lcModemVendorIndex
Set/Get Response/Status:	Number
Description:	An arbitrary index defining an instance of this entry. Ordering is not meaningful.

Control

Variable Name:	lcModemVendorControl
Set/Get Response/Status:	RowStatus: active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	This object controls the creation and deletion of rows in this table.

MacAddress

Variable Name:	lcModemVendorMacAddress
Set/Get Response/Status:	MacAddress
Description:	When masked, identifies a group of modems that are allowed to register at this CMTS. Note that the LSB of the first octet is the multicast bit; since it cannot identify a modem, it is defined to be zero.

Mask

Variable Name:	lcModemVendorMask
Set/Get Response/Status:	MacAddress
Description:	Applied to the MAC address to identify which modems are allowed to register at this CMTS. Ordinarily, the OUI portion is used to identify particular vendors, but arbitrary masks can be used. The LSB of the first octet is the multicast bit and is defined to be zero.

lccmtsDPStatistics

lccmtsDPStatistics is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

lccmtsDPStatisticsInfo

The following paragraph includes the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for the MIB variable in the lccmtsDPStatisticsInfo table.

lcDPStatisticsInterval

Variable Name:	lcDPStatisticsInterval
Set/Get Response/Status:	Number
Description:	Controls the interval at which data rates are calculated on the CMTS.

lcDPStatisticsEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the lcDPStatisticsEntry table.

dot1dTpPort

Variable Name:	dot1dTpPort
Set/Get Response/Status:	Number
Description:	The port number of the port for which this entry contains Transparent Bridging Management information.

TxFrameRate

Variable Name:	lcDPStatisticsTxFrameRate
Set/Get Response/Status:	Number
Description:	The last calculated frames per second transmitted on this port.

RxFrameRate

Variable Name:	lcDPStatisticsRxFrameRate
Set/Get Response/Status:	Number
Description:	The last calculated frames per second received on this port.

TxOctetRate

Variable Name:	lcDPStatisticsTxOctetRate
Set/Get Response/Status:	Number
Description:	The last calculated octets per second transmitted on this port.

RxOctetRate

Variable Name:	lcDPStatisticsRxOctetRate
Set/Get Response/Status:	Number
Description:	The last calculated octets per second received on this port.

lccmtsDPConfigurationInfo

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the lccmtsDPConfigurationInfo table.

ForwardingMode

Variable Name:	lcForwardingMode
Set/Get Response/Status:	Number: none(1), dhcp-arp(2)
Description:	Controls the Forwarding Data Base Learning Mode. If set to none(1), the CMTS uses transparent learning. If set to dhcp-arp(2), the CMTS uses Layer-3 switching, based on DHCP and ARP.

ProxyArp

Variable Name:	lcProxyArp
Set/Get Response/Status:	Number: enable(1), disable(2)
Description:	Controls Proxy ARP on the CMTS when it is in transparent learning mode. If set to enable(1), the CMTS responds to an ARP received from the Cable when the IP Address is known, and responds to an ARP received from the Ethernet when the IP Address is known to be on the Cable. If set to disable(2), CMTS does not respond to any ARPs.

ProxyArpTimeout

Variable Name:	lcProxyArpTimeout
Set/Get Response/Status:	Number
Description:	Controls the timeout (in seconds) of the Proxy Arp cache entries.

lccmDevice

lccmDevice is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

LcScanningFrequencyEntry

This MIB group defines a range of channels to be used by the modem to find the downstream channel.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the lcScanningFrequencyEntry table.

Index

Variable Name:	lcScanIndex
Set/Get Response/Status:	Number
Description:	An ad-hoc index for defining the scanning order for this table.

Control

Variable Name:	lcScanControl
Set/Get Response/Status:	RowStatus – active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	Controls the creation and deletion of rows in this table. See RFC-1903 for definition of enumeration.

FreqStart

Variable Name:	lcScanFreqStart
Set/Get Response/Status:	Number (Kilohertz)
Description:	The center frequency of the first channel to scan in this range.

FreqEnd

Variable Name:	lcScanFreqEnd
Set/Get Response/Status:	Number (Kilohertz)
Description:	The center frequency of the last channel to scan in this range. This may be higher or lower than lcScanFreqStart.

UseHrc

Variable Name:	lcScanUseHrc
Set/Get Response/Status:	TruthValue
Description:	If True then the range is to use the HRC channels which correspond to the Std/IRC channels whose center frequencies are defined by FreqStart and FreqEnd (i.e., offset the values in FreqStart and FreqEnd before using them).

Step

Variable Name:	lcScanStep
Set/Get Response/Status:	Number (Kilohertz)
Description:	The absolute value of the increment (or decrement) to use in stepping through this range.

ChannelWidth

Variable Name:	lcScanChannelWidth
Set/Get Response/Status:	Number (Kilohertz)
Description:	The channel width to use for this range. Only 6000 and 8000 are allowed.

Display lccmAddressInfo Table

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the Display lccmAddressInfo table.

Address

Variable Name:	lccmIpAddress
Set/Get Response/Status:	IP Address
Description:	The IP address of the CM; provides a writable equivalent of ipAdEntAddr. If set to null (0.0.0.0), the address must be provided through DHCP.

Subnet

Variable Name:	lccmIpSubnet
Set/Get Response/Status:	IP Address
Description:	The subnet mask corresponding to lcCM-IpAddress; provides a writable equivalent of ipAdEntNetMask.

lcdevicecommon

lcdevicecommon is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

lctrapvarsinfo

A group that defines variables returned in traps that aren't already defined in other groups. These are Authentication Failure Trap variables, an extention to the RFC1215 authentication failure trap, which don't specify variables.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the lctrapvarsinfo table.

ErrorStatus

Variable Name:	lcAuthFailErrorStatus
Set/Get Response/Status:	Number: nmAccessTableRestriction(1), noWriteAccessToMibVar(2), other(3)
Description:	The reason for failure to validate the SNMP request. nmAccessTableRestriction(1) indicates that the requesting network management station (NMS) does not have appropriate permission to perform the SNMP request. Either it does not match an IP address in the docsDevNmAccessTable, or the community string in the SNMP request did not match the community string in docsDevNmAccessTable for the requesting NMS; or the docsDevNmAccessControl value specified in the docsDevNmAccessTable for this NMS was not sufficient to allow access for the SNMP request type (either “get” or “set”). Or, finally, the SNMP request from this NMS is not accepted on the interface (Ethernet or CATV) that the request was received. noWriteAccessToMibVar(2) indicates that an SNMP set request was received for a MIB variable whose write access control is set. other(3) indicates a nonspecific error.

CommunityString

Variable Name:	lcAuthFailCommunityString
Set/Get Response/Status:	Display String
Description:	This is the community string received in a Get/Set SNMP request that did not pass authentication tests. This object is returned in the authenticationFailure trap.

IpAddress

Variable Name:	lcAuthFailIpAddr
Set/Get Response/Status:	IP Address
Description:	This is the source address of a Get/Set SNMP request that did not pass authentication tests. This object is returned in the authentication-Failure trap.

Interface

Variable Name:	lcAuthFailInterface
Set/Get Response/Status:	Number: ethernet(1), catv(2), other(3)
Description:	This is the interface port on which was received a Get/Set SNMP request that did not pass authentication tests. This object is returned in the authenticationFailure trap.

LcTrapTypeEntry

An entry in this table defines a particular trap type supported by the system.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the LcTrapTypeEntry table.

Index

Variable Name:	lcTrapTypeIndex
Set/Get Response/Status:	Number: coldstartTrap(1), warmstartTrap(2), linkUpTrap(3), linkDownTrap(4), authenticationFailureTrap(5), topologyChangeTrap(6), newRootTrap(7)
Description:	The variable is the index of this entry in the lcTrapTypeTable.

Status

Variable Name:	lcTrapTypeStatus
Set/Get Response/Status:	Number: sendTrap(1), this type of trap should be sent; noTrap(2), this type of trap should NOT be sent
Description:	This variable controls whether this type of trap is generated by this device.

lcMulticastGroup

lcMulticastGroup is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

lcMulticastGroupInfo

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the lcMulticastGroupInfo table.

Control

Variable Name:	lcMcastControl
Set/Get Response/Status:	Number: pass(1), discard(2), igmp(3), trap(4)
Description:	Action to take on receiving an IP multicast packet bound for the subscriber network. If pass(1), the CM acts as a bridge, transparently forwarding all multicast packets. If filter(2), all IP multicast packets are discarded. If igmp(3) then the CM acts as an IGMP proxy and only forwards packets whose addresses were requested by the subscriber. If trap(4) then the CM transmits IGMP queries on the subscriber side. On receiving Reports, it transmits an SNMP trap. Multicast packets are forwarded, and presumably blocked by SNMP-managed filters.

TrapAddress

Variable Name:	lcMcastTrapAddress
Set/Get Response/Status:	IP Address
Description:	The IP multicast address that is included in the lcMcastJoin trap. This object only exists for purposes of inclusion in the trap message.

LcMcastAddressEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the lcMcastAddressEntry table.

Address

Variable Name:	lcMcastAddress
Set/Get Response/Status:	IP Address
Description:	The IP multicast address being managed.

AdminState

Variable Name:	lcMcastAdminState
Set/Get Response/Status:	RowStatus – active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	Controls addition of static entries or deletion of any entries in this table.

OperState

Variable Name:	lcMcastOperState
Set/Get Response/Status:	Number: nonmember(1), delaying(2), idle(3), static(4)
Description:	Reflects the IGMP state of this address. If static(4), the entry was created as a result of management action, and the entry is not subject to the IGMP protocol.

Ttl

Variable Name:	lcMcastTtl
Set/Get Response/Status:	Number: TimeTicks
Description:	Time-to-live for this entry. Will return zero for static entries.

LcPhyEntry

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the LcPhyEntry table.

Index

Variable Name:	lcPhyIndex
Set/Get Response/Status:	Number: primary(1), aux1(2)
Description:	Name/Index for each Ethernet PHY.

Enable

Variable Name:	lcPhyEnable
Set/Get Response/Status:	TruthValue
Description:	If true, this PHY may be used. If false, this will not be used.

AutoNegotiate

Variable Name:	lcPhyAutoNegotiate
Set/Get Response/Status:	TruthValue
Description:	If true, this PHY auto-negotiates if active. If false, this PHY is manually configured if active.

Active

Variable Name:	lcPhyActive
Set/Get Response/Status:	TruthValue
Description:	If true, this PHY is the one being used. If false, this PHY is not being used.

Speed

Variable Name:	lcPhySpeed
Set/Get Response/Status:	Number
Description:	Determines the speed for this PHY. If lcPhyAutoNegotiate is true, writes to this value are prohibited. If lcPhyAutoNegotiate is false, this PHY will be forced to this speed. Valid values are 10000000 and 100000000.

FullDuplex

Variable Name:	lcPhyFullDuplex
Set/Get Response/Status:	TruthValue
Description:	Determines the duplex mode for this PHY. If lcPhyAutoNegotiate is true, writes to this value are prohibited. If lcPhyAutoNegotiate is false, this PHY will be forced to this duplex mode.

LcStickyYellowEntry

This table provides a maintenance-history area where notes about the device may be stored. The contents of this table are entirely for human benefit and have no effect on the operation of the device. Up to 8 entries of up to 80 characters each may be stored.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the LcStickyYellowEntry table.

Index

Variable Name:	lcStickyYellowIndex
Set/Get Response/Status:	Number
Description:	Provides an index by which to distinguish up to eight lines of text.

Pad

Variable Name:	lcStickyYellowPad
Set/Get Response/Status:	DisplayString
Description:	Contents of this object are for the benefit of a human operator and may be used for any information, such as maintenance history, that the operator wishes to associate with the device. Contents of this object have no effect on the operation of the device. Setting this object to any non-null value either creates the row or overwrites previous text. Setting to the null string deletes the row. Sets longer than 80 characters are truncated.

lcdevicecommoninfo

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the lcdevicecommoninfo table.

Filename

Variable Name:	lcBootedAlbumFilename
Set/Get Response/Status:	DisplayString
Description:	The filename that is embedded in the flash album header of the currently booted album software image.

SequenceNumber

Variable Name:	lcBootedAlbumSequenceNumber
Set/Get Response/Status:	Number
Description:	The sequence number of the currently loaded software image.

IpFiltSendDu

Variable Name:	lcIpFiltSendDu
Set/Get Response/Status:	Number: on(1), send DU if packet filtered; off(2), do NOT send DU if packet filtered
Description:	This variable specifies whether a “destination unreachable” ICMP message is sent when a packet is filtered due to IP protocol filtering.

RestartFromFactoryDefaults

Variable Name:	lcRestartFromFactoryDefaults
Set/Get Response/Status:	TruthValue
Description:	Setting this object to true(1) causes the device to reset. When restarting, it will have forgotten all configuration parameters that are normally stored in nonvolatile memory. The device will start up as if delivered from the factory. Reading this object always returns false(2).

DocsBpi

DocsBpi is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings. All of which reside under the MIB variable table name DocsBpi.

DocsBpiCM

DocsBpiCM is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

DocsBpiCmBaseEntry

This group describes the basic and authorization-related Baseline Privacy attributes of each CM MAC interface.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsBpiCmBaseEntry table.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

PrivacyEnable

Variable Name:	docsBpiCmPrivacyEnable
Set/Get Response/Status:	TruthValue
Description:	This identifies whether this CM is provisioned to run Baseline Privacy. This is analogous to the presence (or absence) of the Baseline Privacy Configuration Setting option as described in BPI Appendix A.1.1. The status of each individual SID with respect to Baseline Privacy is captured in the docsBpiCmTEKPrivacyEnable object. Note: This object will be read-write accessible only after the ability to start and stop the authorization state machine is understood.

PublicKey

Variable Name:	docsBpiCmPublicKey
Set/Get Response/Status:	Hex
Description:	Public key of the CM encoded as an ASN.1 SubjectPublicKeyInfo object as defined in the RSA Encryption Standard (PKCS #1) [12].

AuthState

Variable Name:	docsBpiCmAuthState
Set/Get Response/Status:	Number: start(1), authWait(2), authorized(3), reauthWait(4), authRejectWait(5)
Description:	The state of the CM authorization FSM. The start state indicates that FSM is in its initial state.

AuthKeySequenceNumber

Variable Name:	docsBpiCmAuthKeySequenceNumber
Set/Get Response/Status:	Number
Description:	The authorization key sequence number for this FSM.

AuthExpires

Variable Name:	docsBpiCmAuthExpires
Set/Get Response/Status:	DateAndTime
Description:	Actual clock time when the current authorization for this FSM expires. If the CM does not have an active authorization, then the value is of the expiration date and time of the last active authorization.

AuthReset

Variable Name:	docsBpiCmAuthReset
Set/Get Response/Status:	TruthValue
Description:	Setting this object to True generates a Re-authorize event in the authorization FSM, as described in section 4.1.2.3.4 of the Baseline Privacy Interface Specification. Reading this object always returns False.

AuthGraceTime

Variable Name:	docsBpiCmAuthGraceTime
Set/Get Response/Status:	Number (Seconds)
Description:	Grace time for an authorization key. A CM is expected to start trying to get a new authorization key beginning AuthGraceTime seconds before the authorization key actually expires. The value of this object cannot be changed while the authorization state machine is running. Note: This object will be read-write accessible only after the ability to start and stop the authorization state machine is understood.

TEKGraceTime

Variable Name:	docsBpiCmTEKGraceTime
Set/Get Response/Status:	Number (Seconds)
Description:	Grace time for a TEK. A CM is expected to start trying to get a new TEK beginning TEKGraceTime seconds before the TEK actually expires. The value of this object cannot be changed while the authorization state machine is running. Note: This object will be read-write accessible only after the ability to start and stop the authorization state machine is understood.

AuthWaitTimeout

Variable Name:	docsBpiCmAuthWaitTimeout
Set/Get Response/Status:	Number (Seconds)
Description:	Authorize Wait Timeout. The value of this object cannot be changed while the authorization state machine is running. Note: This object will be read-write accessible only after the ability to start and stop the authorization state machine is understood.

ReauthWaitTimeout

Variable Name:	docsBpiCmReauthWaitTimeout
Set/Get Response/Status:	Number (Seconds)
Description:	Reauthorize Wait Timeout in seconds. The value of this object cannot be changed while the authorization state machine is running. Note: This object will be read-write accessible only after the ability to start and stop the authorization state machine is understood.

OpWaitTimeout

Variable Name:	docsBpiCmOpWaitTimeout
Set/Get Response/Status:	Number (Seconds)
Description:	Operational Wait Timeout in seconds. The value of this object cannot be changed while the authorization state machine is running. Note: This object will be read-write accessible only after the ability to start and stop the authorization state machine is understood.

ReKeyWaitTimeout

Variable Name:	docsBpiCmRekeyWaitTimeout
Set/Get Response/Status:	Number (Seconds)
Description:	Rekey Wait Timeout in seconds. The value of this object cannot be changed while the authorization state machine is running. Note: This object will be read-write accessible only after the ability to start and stop the authorization state machine is understood.

AuthRejectWaitTimeout

Variable Name:	docsBpiCmAuthRejectWaitTimeout
Set/Get Response/Status:	Number (Seconds)
Description:	Authorization Reject Wait Timeout in seconds. The value of this object cannot be changed while the authorization state machine is running. Note: This object will be read-write accessible only after the ability to start and stop the authorization state machine is understood.

AuthRequests

Variable Name:	docsBpiCmAuthRequests
Set/Get Response/Status:	Number
Description:	The count of times the CM has transmitted an Authorization Request message.

AuthReplies

Variable Name:	docsBpiCmAuthReplies
Set/Get Response/Status:	Number
Description:	The count of times the CM has received an Authorization Reply message.

AuthRejects

Variable Name:	docsBpiCmAuthRejects
Set/Get Response/Status:	Number
Description:	The count of times the CM has received an Authorization Reject message.

AuthInvalids

Variable Name:	docsBpiCmAuthInvalids
Set/Get Response/Status:	Number
Description:	The count of times the CM has received an Authorization Invalid message.

AuthRejectErrorCode

Variable Name:	docsBpiCmAuthRejectErrorCode
Set/Get Response/Status:	Number: none(1), unknown(2), unauthorizedCm(3), unauthorizedSid(4)
Description:	Error-Code in most recent Authorization Reject message received by the CM. This has value unknown(2), if the last Error-Code value was 0, and none(1), if no Authorization Reject message has been received since reboot.

AuthRejectErrorString

Variable Name:	docsBpiCmAuthRejectErrorString
Set/Get Response/Status:	DisplayString
Description:	Display-String in most recent Authorization Reject message received by the CM. This is a zero length string if no Authorization Reject message has been received since reboot.

AuthInvalidErrorCode

Variable Name:	docsBpiCmAuthInvalidErrorCode
Set/Get Response/Status:	Number: none(1), unknown(2), unauthorizedCm(3), unsolicited(5), invalidKeySequence(6), keyRequestAuthenticationFailure(7)
Description:	Error-Code in most recent Authorization Invalid message received by the CM. This has value unknown(2) if the last Error-Code value was 0, and none(1) if no Authorization Invalid message has been received since reboot.

AuthInvalidErrorString

Variable Name:	docsBpiCmAuthInvalidErrorString
Set/Get Response/Status:	DisplayString
Description:	Display-String in most recent Authorization Invalid message received by the CM. This is a zero length string if no Authorization Invalid message has been received since reboot.

DocsBpiCmTEKEntry

Describes the attributes of each CM Traffic Encryption Key (TEK) association. The CM maintains (no more than) one TEK association per SID per CM MAC interface.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsBpiCmTEKEntry table.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

IfCmServiceId

Variable Name:	docsIfCmServiceId
Set/Get Response/Status:	Number
Description:	Identifies a service queue for upstream bandwidth. The attributes of this service queue are shared between the CM and the CMTS. The CMTS allocates upstream bandwidth to this service queue based on requests from the CM and on the class of service associated with this queue.

BpiCmTEKPrivacyEnable

Variable Name:	docsBpiCmTEKPrivacyEnable
Set/Get Response/Status:	TruthValue
Description:	This identifies whether this SID is provisioned to run Baseline Privacy. This is analogous to enabling Baseline Privacy on a provisioned SID using the Class-of-Service Privacy Enable option as described in BPI Appendix A.1.2. This object may be set to True or False at any time (causing the CM to send a Reauth event to the authorization machine), regardless of whether Baseline Privacy is enabled for the CM. However, Baseline Privacy is not effectively enabled for any SID unless Baseline Privacy is enabled for the CM, which is managed via the docsBpiCmPrivacyEnable object.

BpiCmTEKState

Variable Name:	docsBpiCmTEKState
Set/Get Response/Status:	Number: start(1), opWait(2), opReauthWait(3), operational(4), rekeyWait(5), rekeyReauthWait(6)
Description:	The state of the indicated TEK FSM. The start(1) state indicates that FSM is in its initial state.

BpiCmTEKExpiresOld

Variable Name:	docsBpiCmTEKExpiresOld
Set/Get Response/Status:	DateAndTime
Description:	Actual clock time for expiration of the oldest active key for this FSM. If this FSM has no active keys, then the value is of the expiration date and time of the last active key.

BpiCmTEKExpiresNew

Variable Name:	docsBpiCmTEKExpiresNew
Set/Get Response/Status:	DateAndTime
Description:	Actual clock time for expiration of the newest active key for this FSM. If this FSM has no active keys, then the value is of the expiration date and time of the last active key.

BpiCmTEKKeyRequests

Variable Name:	docsBpiCmTEKKeyRequests
Set/Get Response/Status:	Number
Description:	The count of times the CM has transmitted a Key Request message.

BpiCmTEKKeyReplies

Variable Name:	docsBpiCmTEKKeyReplies
Set/Get Response/Status:	Number
Description:	The count of times the CM has received a Key Reply message.

BpiCmTEKKeyRejects

Variable Name:	docsBpiCmTEKKeyRejects
Set/Get Response/Status:	Number
Description:	The count of times the CM has received a Key Reject message.

BpiCmTEKInvalids

Variable Name:	docsBpiCmTEKInvalids
Set/Get Response/Status:	Number
Description:	The count of times the CM has received a TEK Invalid message.

BpiCmTEKAuthPends

Variable Name:	docsBpiCmTEKAuthPends
Set/Get Response/Status:	Number
Description:	The count of times an Authorization Pending (Auth Pend) event occurred in this FSM.

BpiCmTEKKeyRejectErrorCodes

Variable Name:	docsBpiCmTEKKeyRejectErrorCode
Set/Get Response/Status:	Number: none(1), unknown(2), unauthorized-Sid(4)
Description:	Error-Code in most recent Key Reject message received by the CM. This has value unknown(2) if the last Error-Code value was 0, and none(1) if no Key Reject message has been received since reboot.

BpiCmTEKKeyRejectErrorString

Variable Name:	docsBpiCmTEKKeyRejectErrorString
Set/Get Response/Status:	DisplayString
Description:	Display-String in most recent Key Reject message received by the CM. This is a zero length string if no Key Reject message has been received since reboot.

BpiCmTEKInvalidErrorCode

Variable Name:	docsBpiCmTEKInvalidErrorCode
Set/Get Response/Status:	Number: none(1), unknown(2), invalidKey-Sequence(6)
Description:	Error-Code in most recent TEK Invalid message received by the CM. This has value unknown(2) if the last Error-Code value was 0, and none(1) if no TEK Invalid message has been received since reboot.

BpiCmTEKInvalidErrorString

Variable Name:	docsBpiCmTEKInvalidErrorString
Set/Get Response/Status:	DisplayString
Description:	Display-String in most recent TEK Invalid message received by the CM. This is a zero length string if no TEK Invalid message has been received since reboot.

DocsBpiCMTS

DocsBpiCMTS is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

DocsBpiCmtsBaseEntry

This group describes the basic and authorization-related Baseline Privacy attributes of each CMTS MAC interface.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsBpiCmtsBaseEntry table.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

AuthLifetime

Variable Name:	docsBpiCmtsDefaultAuthLifetime
Set/Get Response/Status:	Number (Seconds)
Description:	Default lifetime, in seconds, the CMTS assigns to a new authorization key.

TEKLifetime

Variable Name:	docsBpiCmtsDefaultTEKLifetime
Set/Get Response/Status:	Number (Seconds)
Description:	Default lifetime, in seconds, the CMTS assigns to a new Traffic Encryption Key (TEK).

AuthGraceTime

Variable Name:	docsBpiCmtsDefaultAuthGraceTime
Set/Get Response/Status:	Number (Seconds)
Description:	Default grace time, in seconds, the CMTS uses for an authorization key. This controls how far in advance of authorization key expiration that the CMTS is expected to produce the next generation of keying material. This value is expected to agree with the Authorization Grace Time that the provisioning system provides to CMs.

TEKGraceTime

Variable Name:	docsBpiCmtsDefaultTEKGraceTime
Set/Get Response/Status:	Number (Seconds)
Description:	Default grace time, in seconds, the CMTS uses for a Traffic Encryption Key (TEK). This controls how far in advance of TEK expiration that the CMTS is expected to produce the next generation of keying material. This value is expected to agree with the TEK Grace Time that the provisioning system provides to CMs. Note that this object is particularly relevant for multicast SIDs, where multiple grace time values cannot be honored.

Requests

Variable Name:	docsBpiCmtsAuthRequests
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has received an Authorization Request message from any CM.

Replies

Variable Name:	docsBpiCmtsAuthReplies
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted an Authorization Reply message to any CM.

Rejects

Variable Name:	docsBpiCmtsAuthRejects
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted an Authorization Reject message to any CM.

Invalids

Variable Name:	docsBpiCmtsAuthInvalids
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted an Authorization Invalid message to any CM.

DocsBpiCmtsAuthEntry

Describes the attributes of each CM authorization association. The CMTS maintains one authorization association with each Baseline Privacy-enabled CM on each CMTS MAC interface.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsBpiCmtsAuthEntry table.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

MacAddress

Variable Name:	docsBpiCmtsAuthCmMacAddress
Set/Get Response/Status:	MacAddress
Description:	The physical address of the CM to which the authorization association applies.

PublicKey

Variable Name:	docsBpiCmtsAuthCmPublicKey
Set/Get Response/Status:	Hex
Description:	Public key of the CM encoded as an ASN.1 SubjectPublicKeyInfo object as defined in the RSA Encryption Standard (PKCS #1) [12]. This is a zero-length string if the CMTS does not retain the public key.

KeySequenceNumber

Variable Name:	docsBpiCmtsAuthCmKeySequenceNumber
Set/Get Response/Status:	Number
Description:	The authorization key sequence number for this CM.

Expires

Variable Name:	docsBpiCmtsAuthCmExpires
Set/Get Response/Status:	DateAndTime
Description:	Actual clock time when the current authorization for this CM expires. If this CM does not have an active authorization, then the value is of the expiration date and time of the last active authorization.

Lifetime

Variable Name:	docsBpiCmtsAuthCmLifetim
Set/Get Response/Status:	Number (Seconds)
Description:	Lifetime, in seconds, the CMTS assigns to an authorization key for this CM.

GraceTime

Variable Name:	docsBpiCmtsAuthCmGraceTime
Set/Get Response/Status:	Number (Seconds)
Description:	Grace time for the authorization key in seconds. The CM is expected to start trying to get a new authorization key beginning AuthGraceTime seconds before the authorization key actually expires.

Reset

Variable Name:	docsBpiCmtsAuthCmReset
Set/Get Response/Status:	Number: noResetRequested(1), invalidateAuth(2), sendAuthInvalid(3), invalidateTeks(4)
Description:	Setting this object to invalidateAuth(2) causes the CMTS to invalidate the current CM authorization key, but not to transmit an Authorization Invalid message nor to invalidate unicast TEKs. Setting this object to sendAuthInvalid(3) causes the CMTS to invalidate the current CM authorization key, and to transmit an Authorization Invalid message to the CM, but not to invalidate unicast TEKs. Setting this object to invalidateTeks(4) causes the CMTS to invalidate the current CM authorization key, to transmit an Authorization Invalid message to the CM, and to invalidate all unicast TEKs associated with this CM authorization. Reading this object returns the most-recently-set value of this object, or returns noResetRequested(1) if the object has not been set since the last CMTS reboot.

Requests

Variable Name:	docsBpiCmtsAuthCmRequests
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has received an Authorization Request message from this CM.

Replies

Variable Name:	docsBpiCmtsAuthCmReplies
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted an Authorization Reply message to this CM.

Rejects

Variable Name:	docsBpiCmtsAuthCmRejects
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted an Authorization Reject message to this CM.

Invalids

Variable Name:	docsBpiCmtsAuthCmInvalids
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted an Authorization Invalid message to this CM.

ErrorCode1

Variable Name:	docsBpiCmtsAuthRejectErrorCode
Set/Get Response/Status:	Number: none(1), unknown(2), unauth-orizedCm(3), unauthorizedSid(4)
Description:	Error-Code in most recent Authorization Reject message transmitted to the CM. This has value unknown(2) if the last Error-Code value was 0, and none(1) if no Authorization Reject message has been transmitted to the CM.

ErrorString2

Variable Name:	docsBpiCmtsAuthRejectErrorString
Set/Get Response/Status:	DisplayString
Description:	Display-String in most recent Authorization Reject message transmitted to the CM. This is a zero length string if no Authorization Reject message has been transmitted to the CM.

ErrorCode

Variable Name:	docsBpiCmtsAuthInvalidErrorCode
Set/Get Response/Status:	Number: none(1), unknown(2), unauthorizedCm(3), unsolicited(5), invalidKeySequence(6), keyRequestAuthenticationFailure(7)
Description:	Error-Code in most recent Authorization Invalid message transmitted to the CM. This has value unknown(2) if the last Error-Code value was 0, and none(1) if no Authorization Invalid message has been transmitted to the CM.

ErrorString

Variable Name:	docsBpiCmtsAuthInvalidErrorString
Set/Get Response/Status:	DisplayString
Description:	Display-String in most recent Authorization Invalid message transmitted to the CM. This is a zero length string if no Authorization Invalid message has been transmitted to the CM.

DocsBpiCmtsTEKEntry

Describes the attributes of each CM Traffic Encryption Key (TEK) association. The CMTS maintains one TEK association per SID on each CMTS MAC interface.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsBpiCmtsTEKEntry table.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

IfCmtsServiceId

Variable Name:	docsIfCmtsServiceId
Set/Get Response/Status:	Number
Description:	Identifies a service queue for upstream bandwidth. The attributes of this service queue are shared between the Cable Modem and the Cable Modem Termination System. The CMTS allocates upstream bandwidth to this service queue based on requests from the CM and on the class of service associated with this queue.

BpiCmtsTEKLifetime

Variable Name:	docsBpiCmtsTEKLifetime
Set/Get Response/Status:	Number (Seconds)
Description:	Lifetime, in seconds, the CMTS assigns to keys for this TEK association.

BpiCmtsTEKGraceTime

Variable Name:	docsBpiCmtsTEKGraceTime
Set/Get Response/Status:	Number (Seconds)
Description:	Grace time for the TEK in seconds. The CM is expected to start trying to get a new TEK beginning, TEKGraceTime, seconds before the TEK actually expires.

BpiCmtsTEKExpiresOld

Variable Name:	docsBpiCmtsTEKExpiresOld
Set/Get Response/Status:	DateAndTime
Description:	Actual clock time for expiration of the oldest active key for this TEK association. If this TEK association has no active keys, then the value is of the expiration date and time of the last active key.

BpiCmtsTEKExpiresNew

Variable Name:	docsBpiCmtsTEKExpiresNew
Set/Get Response/Status:	DateAndTime
Description:	Actual clock time for expiration of the newest active key for this TEK association. If this TEK association has no active keys, then the value is of the expiration date and time of the last active key.

BpiCmtsTEKReset

Variable Name:	docsBpiCmtsTEKReset
Set/Get Response/Status:	TruthValue
Description:	Setting this object to True causes the CMTS to invalidate the current active TEK(s) (plural due to key transition periods), and to generate a new TEK for the associated SID. Reading this object always returns False.

BpiCmtsKeyRequests

Variable Name:	docsBpiCmtsKeyRequests
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has received a Key Request message.

BpiCmtsKeyReplies

Variable Name:	docsBpiCmtsKeyReplies
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted a Key Reply message.

BpiCmtsKeyRejects

Variable Name:	docsBpiCmtsKeyRejects
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted a Key Reject message.

BpiCmtsTEKInvalids

Variable Name:	docsBpiCmtsTEKInvalids
Set/Get Response/Status:	Number
Description:	The count of times the CMTS has transmitted a TEK Invalid message.

BpiCmtsKeyRejectErrorCode

Variable Name:	docsBpiCmtsKeyRejectErrorCode
Set/Get Response/Status:	Number: none(1), unknown(2), unauth-orizedSid(4)
Description:	Error-Code in the most recent Key Reject message sent in response to a Key Request for this BPI SID. This has value unknown(2), if the last Error-Code value was 0, and none(1), if no Key Reject message has been received since reboot.

BpiCmtsKeyRejectErrorString

Variable Name:	docsBpiCmtsKeyRejectErrorString
Set/Get Response/Status:	DisplayString
Description:	Display-String in the most recent Key Reject message sent in response to a Key Request for this BPI SID. This is a zero length string if no Key Reject message has been received since reboot.

BpiCmtsTEKInvalidErrorCode

Variable Name:	docsBpiCmtsTEKInvalidErrorCode
Set/Get Response/Status:	Number: none(1), unknown(2), invalidKey-Sequence(6)
Description:	Error-Code in the most recent TEK Invalid message sent in association with this BPI SID. This has value unknown(2), if the last Error-Code value was 0, and none(1), if no TEK Invalid message has been received since reboot.

BpiCmtsTEKInvalidErrorString

Variable Name:	docsBpiCmtsTEKInvalidErrorString
Set/Get Response/Status:	DisplayString
Description:	Display-String in the most recent TEK Invalid message sent in association with this BPI SID. This is a zero length string if no TEK Invalid message has been received since reboot.

CmtsBpiMulticast

CmtsBpiMulticast is the menu heading for a category of MIB variable groups. These groups reside under additional MIB group sub-headings.

DocsBpiMulticastMapEntry

This group describes the mapping of IP multicast address prefixes to multicast SIDs on each CMTS MAC interface.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsBpiMulticastMapEntry table.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

Address

Variable Name:	docsBpiIpMulticastAddress
Set/Get Response/Status:	IP Address
Description:	The IP multicast address (prefix) to be mapped.

PrefixLength

Variable Name:	docsBpiIpMulticastPrefixLength
Set/Get Response/Status:	Number
Description:	The IP multicast address prefix length to be mapped.

ServiceId

Variable Name:	docsBpiIpMulticastServiceId
Set/Get Response/Status:	Number
Description:	The multicast SID to be used in this IP multicast address prefix mapping entry. DEFVAL is an unused multicast SID value chosen by CMTS.

MapControl

Variable Name:	docsBpiIpMulticastMapControl
Set/Get Response/Status:	RowStatus: active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	Controls and reflects the IP multicast address prefix mapping entry.

DocsBpiMulticastAuthEntry

Describes the multicast SID authorization for each CM on each CMTS MAC interface.

The following paragraphs include the SNMP Syntax (Set/Get Response and/or Status) and a general description of the status entry for each MIB variable in the DocsBpiMulticastAuthEntry table.

ifIndex

Variable Name:	ifIndex
Set/Get Response/Status:	Number
Description:	A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value of each interface must remain constant at least from one reinitialization of the emtity's network management system to the next reinitialization.

ServiceId

Variable Name:	docsBpiMulticastServiceId
Set/Get Response/Status:	Number
Description:	The multicast SID for authorization.

CmMacAddress

Variable Name:	docsBpiMulticastCmMacAddress
Set/Get Response/Status:	MacAddress
Description:	The MAC address of the CM to which the multicast SID authorization applies.

AuthCode

Variable Name:	docsBpiMulticastAuthControl
Set/Get Response/Status:	RowStatus: active, notInService, notReady, createAndGo, createAndWait, destroy
Description:	Controls and reflects the CM authorization for each multicast SID.

Loading and Compiling the MIB

When using the CastleRock SNMP manager, SNMPc™, the order in which the MIB is compiled is critical. The following list provides the best loading sequence for the CMTS 1000 SNMP MIBs.

1. standard.mib
2. snmpv2.mib
3. rfc1213.mib
4. rfc1215.mib
5. rfc1493.mib
6. rfc1573.mib
7. rfc1643.mib
8. mcnsif_snmpc.mib
9. mcnsscm_snmpc.mib
10. lancityheader.mib
11. lancity.mib
12. bpi.mib
13. other mibs

Chapter 5
Modifying and Upgrading the CMTS 1000

Introduction

The CMTS 1000 use the Trivial File Transfer Protocol (TFTP) to perform software upgrades. The following sections describe how to upgrade Bay Network's Cable Modem and Cable Modem Termination System run-time software.

Bay Network's CMTS 1000 can be upgraded manually using an SNMP manager, both on-line and off-line. The modems can also be automatically upgraded using the LCn Provisioning Server.

Upgrade Recommendations

- Read software upgrade “readme” file for latest released software upgrade information.
- Use a standard Simple Network Management Protocol (SNMP) management station such as CastleRock’s SNMPc™.
- Have the network manager and TFTP file server residing on the same PC.
- Ensure the person that is performing the software upgrade is proficient in the operation and configuration of DOCSIS Cable Modems and Cable Modem Termination Systems.

Traffic should be minimal on the network during the upgrade process (including any automatic network management polling such as SNMPc™ Trend Watch and Auto Discover). After the upgrade has started, the process takes approximately one minute per cable modem or Cable Modem Termination System. Network users should be notified that they will experience interruptions during the upgrade process.

Preliminary Upgrade Steps

Become familiar with the upgrade process before attempting to execute.

Ensure that all the required materials are at hand.

Transfer upgrade software from the FTP server or Web Site to appropriate TFTP Server directory.

If performing a manual upgrade using an SNMP manager, configure the Docs_Software Group parameters in the DocsDev MIB for each cable modem device being upgraded.

If implementing the automatic software upgrade procedure, ensure that the LCn Provisioning Server has the proper upgrade file information.

Caution: When implementing the Automatic Upgrade process, do not attempt to automatically upgrade more than 10 units during one upgrade period, using a single-threaded server. A multithreaded server should be limited to 25 units per upgrade session.

Upgrade Procedure

There are six basic steps to perform an upgrade to a CMTS 1000 using a standard SNMP manager.

1. Verify contents of upgrade package.
2. Configure TFTP file server.
3. Ensure modems and headend systems can communicate with the TFTP server.
4. Initiate upgrade process.
5. Upgrade and compile the latest cable modem SNMP MIB.
6. Verify upgrade completed successfully.

Step #1: Verify Contents of Upgrade Package

The distribution method for the CMTS 1000 upgrade is via a Bay Network-maintained FTP server and web site. Upgrade software directories will include separate software files for the CMTS 1000. All pertinent SNMP MIB files are also included. Refer to Chapter 4, Troubleshooting, for the proper loading sequence for the various MIBs.

Step #2: Configure TFTP File Server

Perform the following procedure to setup the TFTP file server and install the upgrade software.

Set the TFTP server's default or public directory to the directory where you will be copying the upgrade software.

Copy the CMTS 1000 upgrade software files to the TFTP server's default directory. We recommend using the data directory that you use to save and provision the cable modem's configuration and MD5 files.

Step #3: Ensure Devices Can Communicate with the TFTP Server

Reset each device before attempting to upgrade to verify the following:

- Connection to the TFTP server
- Correctness of the configuration database information
- Configuration parameters haven't changed since last reboot

To reset a device using SNMP:

1. Select the device.
2. Select the DocsDev MIB Object ID.
3. Select the Docs_Base MIB Object ID.
4. Change the True/False selection of the ResetNow MIB to True.
5. Press the Set button.

The cable modem or Cable Modem Termination System will reset.

Using the TFTP server's visual display, ensure that the cable modem device is served its configuration file.

Step #4: Initiate Upgrade Process

Software Upgrade via SNMP

Use the following procedure to upgrade a CMTS 1000 using an SNMP manager.

1. Select cable modem device to be upgraded.
2. Select the DocsDev MIB Object ID.
3. Select the Docs_Software MIB Object ID. The SNMP manager displays the softwareInfo Table.
4. Set the Server IP Address to the IP Address of the TFTP server.
5. Set the Filename to the filename of the upgrade software that you copied into the TFTP server's default directory. Enter only the filename. Do not enter the full path to the TFTP server's public directory.

Caution: All parameters must be set exactly as stated. Verify that all previous steps are complete and accurate, especially file names and IP Addresses. Verify that the TFTP server is On and the loadable file is in the TFTP server's public directory. Verify that you still have connectivity with the unit, and the unit is running well.

6. Initiate the upgrade process by setting the AdminStatus MIB to upgradeFromMgt.

You can monitor the process if your TFTP server has a display window, or returns status information to you. The process takes about one minute.

Software Upgrade via the LCn Provisioning Server's Automatic Software Upgrade

You can setup your cable modem devices to upgrade automatically. Perform the following procedure to have your CMTS 1000s upgrade automatically.

1. Open the DOCSIS LCn Provisioning Server.
   - Select and edit the Networks module to initiate a global automatic software upgrade.
   - Select and edit the Modems module to initiate selective modem auto upgrades.
   - Select and edit the CMTS module to initiate selective CMTS auto upgrades.
2. Type the software upgrade filename in the Upgrade File Name window of the selected module. When performing a global auto upgrade, make sure that you press the Apply to Modems button, before you leave the edit Network screen.
3. Press the Update Network Configuration Files button on the LCn Control Panel.
4. Return to Step #2 and verify that the TFTP server is running and set up as discussed.

The auto upgrade process begins upon a reset of the CMTS 1000. You can monitor the process if your TFTP server has a display window or returns status information to you.

Step #5: Upgrade and Compile the Latest CMTS SNMP MIB

The new MIB must now be loaded and compiled to allow proper SNMP management of the cable modems and headend equipment that you upgraded. Refer to Chapter 4, Troubleshooting, for the proper loading sequence of the MIB files.

Refer to Chapter 4, Troubleshooting, for detailed descriptions of the CMTS 1000 MIB variables.

Step #6: Verify Upgrade Completed Successfully

Using an SNMP manager, verify the software version of the upgraded CMTS 1000 as follows:

1. Using MIB II, select Basic.
2. Select System and List System Info.
3. The SNMP manager displays the SystemInfo Table.
4. The Object ID indicates the product ID and the software version.
5. If you're using SNMPc, you can click on the SNMPc Poll button.

The manager will display the IP Address of the selected device, and the product ID along with the software version.

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